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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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A GERMAN MANUAL OF SCIENTIFIC INQUIRY

Anleitung zu wissenschaftlichen Beobachtungen auf Reisen mit besonderer Rücksicht auf die Bedürfnisse der Kaiserlichen Marine. Edited by Dr. G. Neumayer. (Berlin, Oppenheim; London, Trübner, 1875.)

IN estimating the merits of a work like this German Manual, we must bear in mind that ordinary treatises are not what a traveller asks for. These are primarily written for the use of students, not for that of investigators, and the stand-points of the student and of the investigator are wholly different. The student takes a position in the very heart of the great continent of established knowledge, and his aim is to familiarise himself with what is already known, but the investigator places himself on the frontier of that continent, and is always directing his thoughts into the illimitable regions of the unknown. It is therefore obvious that the books needed by a traveller must be composed in a different spirit to those intended for students. They must summarise, so far as possible in the small space that is available, the most advanced knowledge of the several sciences; they must dwell at length upon what is *not* known, and they must explain how processes, commonly carried on at a table, with abundant appliances, may be undertaken in the open air, amid the manifold discomforts of a journey and in the isolation to which every traveller is necessarily obliged to submit. The satisfactory combination of these three requirements is hard to accomplish, while it is scarcely possible for anyone who has not himself been a traveller to do justice to the last of them.

Dr. Neumayer informs us that the present work, of which he is the editor and to which he has himself contributed an important and well-illustrated memoir on Hydrography, took its origin in a meeting of scientific men at Berlin. They recognised the merits of the English "Admiralty Manual of Scientific Inquiry," which appears to be much appreciated by German navigators, but they felt that a more elaborate work might advantageously be supplied, having special reference to German culture and needs. The result of the conference has been the production of this volume. It contains contributions from twenty-eight men, all experts in what they write about, many of them of the highest distinction, and many of them travellers. It is therefore impossible but that such a compendium should be of sterling worth. Unfortunately it is equally impossible for us, in a short review of so encyclopædic an undertaking, to give more than a partial idea of it.

The authors, as we might expect, have treated their subjects in very different ways, so that there is much individuality in their writings, and perhaps some disproportion in the spaces allotted to the several subjects. Again, some of the best memoirs are on topics where one would have least hoped to meet with interesting matter; thus, Dr. A. Meitzin has drawn up an exceedingly instructive memoir on Political Geography and Statistics, and Dr. Friedel one on Medical Science. There is a masterly and original treatise by Dr. Koner on the unexplored parts of the world and on geographical features generally; and Kieppert contributes an article on Flying Surveys. Von Richthoven, of Chinese celebrity, writes a memoir on Geology, throughout which the special turn of mind of an accomplished traveller is conspicuous; and the African explorer, Schweinfurth, gives one on the collection and preservation of plants; while Dr. Günther, of the British Museum, writes upon reptiles and fish. In short, all the branches of zoology and botany are excellently represented. Dr. Steinthal has contributed a very instructive paper on linguistic inquiry, showing, among other things, the sort of conversation that a traveller should encourage in order to procure synonyms and nice distinctions of words; also to obtain correct ideas of construction. Thus he has pages of such words or phrases as these: "The sky; clouds; the sky is clear, is cloudy. Wind, the wind blows; storm; whirlwind. The sun is risen, is set, burns hotly. The moon, new moon; there is no moon; stars; comet; meteor," &c. This ought to afford an excellent guide to persons desirous of compiling vocabularies of hitherto unwritten languages. The only paper to which exception might be taken is that on fixing geographical positions; for, however sound it may be, it is written from the point of view of a University professor, and omits the matters connected with the carriage and manipulation of instruments under the difficulties inseparable from rough travel, which are precisely those about which the traveller most needs information.

The volume contains almost seven hundred pages, large octavo, in a rather small but readable type. Thanks to its being issued on paper that is neither thick nor heavy, it forms by no means an unwieldy book. There can be no doubt that it will become a standard work for all travellers who can read German. It wants an index, because, although it is divided into twenty-eight sections, it is by no means easy to hunt out a required passage, especially as the memoirs necessarily encroach upon the provinces of one another; if the book be translated into English, this want ought to be supplied. Again, it is only to some of the memoirs that a list of special works of reference is appended. These lists are extremely useful to persons preparing for a journey, and all the memoirs should have been furnished with them. If such lists should ever be compiled, and if the works to which they refer were freely added to the libraries in the capitals of the various colonies, they would be of the greatest assistance to travellers, temporarily resident, while completing their preparations for a start, or in putting their materials into order in the interval between two journeys.

In concluding these remarks, attention may serviceably be directed to a desideratum, not only of scientific travellers, but of all who, having been well grounded in science, occupy themselves occasionally in scientific research; namely, a book that shall contain the principal constants and formulæ of every branch of science, each accompanied by a short reminder, as it were, of the method by which it was obtained. Such a book, suitable to the state of knowledge at the bygone time when it was written, is actually in existence, namely, Carr's "Synopsis" (published by Weld). The condensation, elegance, and precison of its style are worthy of the highest commendation. It was a *vade mecum* of the late Mr. Babbage, to

whom the writer of these lines was first indebted for a knowledge of its existence, but it is now out of date. It is sincerely to be desired that a band of scientific professors to whom the necessary formulæ are familiar would be disposed to co-operate in producing a work similar to Carr's "Synopsis," but extended to all branches of science, and in accordance with the most advanced state of knowledge of the day. F. G.

THE SANDWICH ISLANDS

The Hawaiian Archipelago. Six Months among the Palm Groves, Coral Reefs, and Volcanoes of the Sandwich Islands. By Isabella J. Bird. With Illustrations. (London: John Murray, 1875.)

WE fear there are few who have any definite idea of the situation of the Sandwich Islands, or indeed of any of the other numerous groups that bestar the blue Pacific.

The Sandwich Islands lie upwards of 2,000 miles south-west of San Francisco, and consist of fifteen islands, of which only eight appear to be inhabited, viz., Hawaii, Mauai, Lanai, Kahoolawe, Molokai, Oahu, Kaui, and Niihau. The total area is about 7,000 square miles, and the native population is under 50,000. There are besides upwards of 5,000 foreigners, the Chinese being more largely represented than any other nation, Americans and British coming next. There is, however, a large native white population, descendants of American missionaries and others who settled in the islands years ago; most of the Government offices—for the Sandwich group has a Constitutional Monarchy—being filled by whites of this class. The islands have for many years been professedly Christian in religion. They extend from 18° 50′ to 22° 20′ N. lat., and from 154° 53′ to 160° 15 W. long. Their official designation is the "Hawaiian Islands." "Their climate for salubrity and general equa-

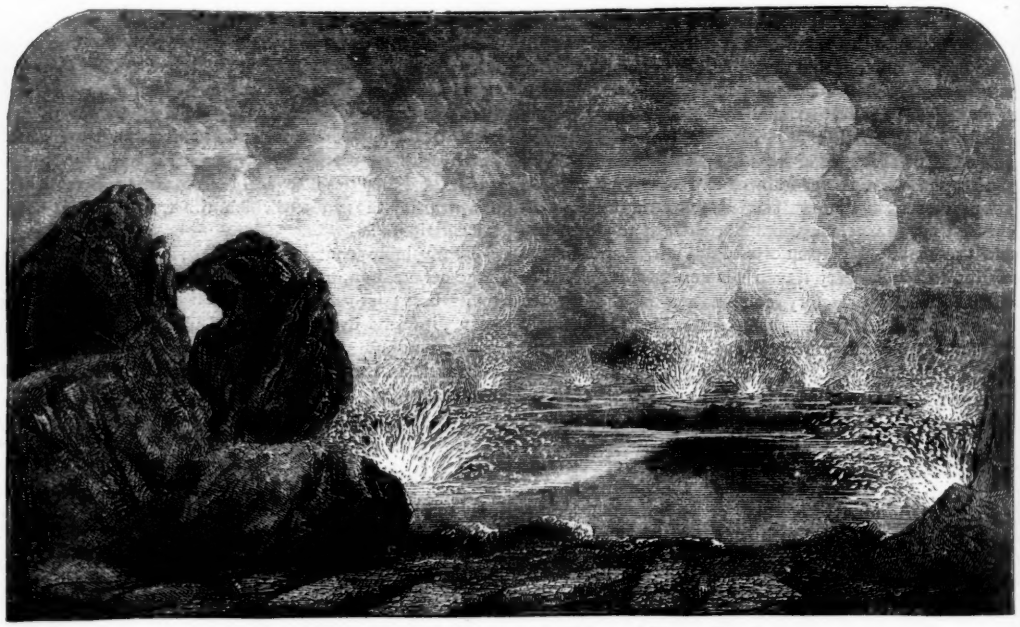

FIG. 1.—A Night Scene in the Crater of the Volcano of Kilauea, Hawaii.

bility is reputed the finest on earth. It is almost absolutely equable, and a man may take his choice between broiling all the year round on the sea level on the leeward side of the islands at a temperature of 80°, and enjoying the charms of a fireside at an altitude where there is frost every night of the year. There is no sickly season, and there are no diseases of locality. The trade winds blow for nine months of the year, and on the windward coasts there is an abundance of rain, and a perennial luxuriance of vegetation."

So says Miss Bird, whose delightful book we recommend to all who wish for a full and graphic account of the present condition of the Sandwich Islands and islanders. She spent seven months of the year 1873 on the islands for the sake of her health, rode and sailed and climbed about fearlessly everywhere, using her eyes to the very best advantage. The result is, that in less than 500 pages she gives a panoramic picture of the various phases of nature and life in the Sandwich Islands, which leaves little to be desired.

The largest of the islands is Hawaii—its area is 4,000 square miles—but the capital, Honolulu, the headquarters of one of our Transit expeditions, is on Oahu. Hawaii Miss Bird calls a huge slag, and the same, we fancy, may be said of most of the other islands; everywhere there are unmistakable signs of the fiercest volcanic outbursts, and every now and again are the inhabitants reminded of the instability of the foundations of their lovely dwelling-place. Nevertheless, nobody in Hawaii troubles himself with the thought

of the terrible possibilities that may at any moment happen. Natives and foreign residents appear to resign themselves unreservedly to the perpetual "afternoon" influence of the land, where there seems to be little need of "taking thought for the morrow."

Miss Bird gives us many glimpses of the luxuriant vegetation which is to be found almost everywhere on the lower slopes of the islands; a mere list of the various trees to be met with would occupy more space than we can afford. Almost all the roots and fruits of the torrid and temperate zones can be grown on the islands, though the *flora* is far scantier than that of the South Sea groups. The indigenous fauna is small, consisting only of hogs, dogs, goats, and an anomalous bat that flies by day. There are few insects except such as have been imported, and there is no great variety of bird-life.

In Hawaii, as well as in others of the islands, the coast line is everywhere broken by deep "gulches" or ravines, often from 1,000 to 2,000 feet in depth, running for miles into the interior, clothed from top to bottom of their nearly perpendicular sides with almost impenetrable vegetation, and having the narrow valleys below raked by torrent-like rivers, which are often swollen to many hundred yards in breadth.

No doubt the principal attraction to the scientific reader in Miss Bird's narrative will be her account of the visits which she was brave and determined enough to make to the volcanoes, active and extinct, on Hawaii and Mauai. All the principal islands of the group, being of volcanic origin, are more or less mountainous, ranging in extreme height from 400 ft. in Kahoolawe to close on 14,000 in Hawaii, the loftiest island in Oceania. As our readers,

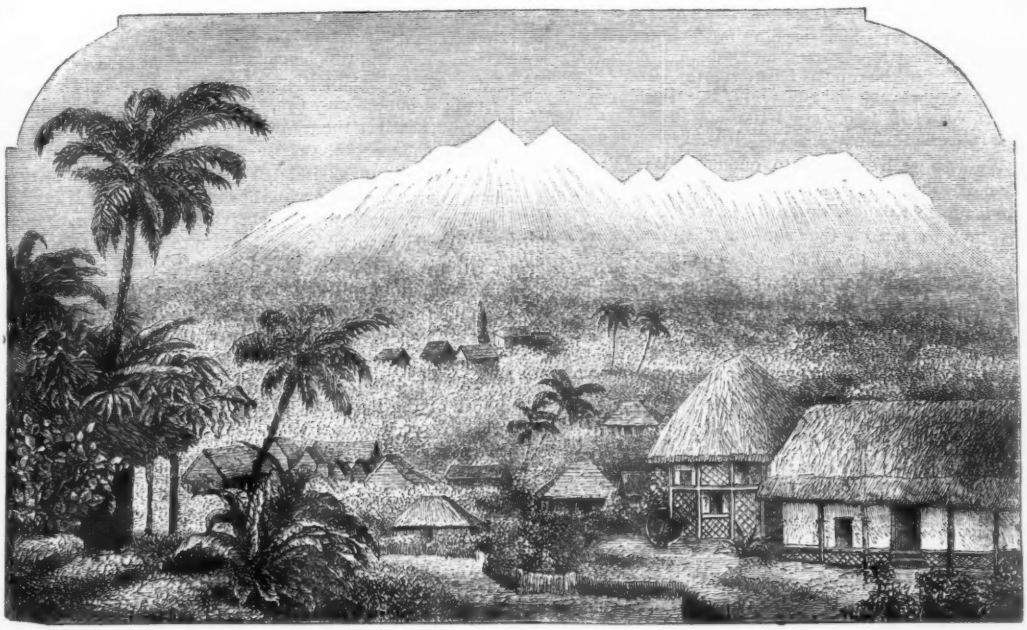

FIG. 2.—The Mountain Mauna Kea from Hilo.

no doubt, know, there are on the island of Hawaii two active and at least two extinct volcanoes; indeed, almost everywhere in the interior evidence of former volcanic action is to be met with. "To the south of the Waimea plains violent volcanic action is everywhere apparent, not only in tufa cones, but in tracts of ashes, scoriæ, and volcanic sand."

Mauna Loa, somewhat to the south of the centre of the island of Hawaii, is the highest active volcano in the world, rising to a height of 13,760 feet. The whole of the south side of Hawaii, down to and below the water's edge, is composed of its slopes, its base being 180 miles in circumference. "Its whole bulk above a height of 8,000 feet is one frightful desert," though vegetation, in the form of grey lichens, a little withered grass, and a hardy asplenium, extends 2,000 feet further up. During Miss Bird's visit to the summit, the thermometer registered 11° of frost. The crater Mokuaweoweo, is six miles in circumference, 11,000 feet long, 8,000 feet wide, with precipitous sides 800 feet deep. The crater appears to be in a state of constant activity, and at times overflows, carrying destruction to the lowest levels of the island. Miss Bird tells us that since white men inhabited the islands there have been ten eruptions from Mauna Loa. Of the condition of the crater, the following description, by Miss Bird, of what she saw on her visit, accomplished amid hardships that few men would care to undergo, will give the reader a vivid idea:—

"When the sun had set, and the brief red glow of the tropics had vanished, a new world came into being, and wonder after wonder flashed forth from the previously lifeless crater. Everywhere through its vast expanse appeared glints of fire—fires bright and steady, burning in rows like blast furnaces; fires lone and isolated, un-

winking like planets, or twinkling like stars; rows of little fires marking the margin of the lowest level of the crater; fire molten in deep *crevasses;* fire in wavy lines; fire, calm, stationary, and restful: an incandescent lake two miles in length beneath a deceptive crust of darkness, and whose depth one dare not fathom even in thought. Broad in the glare, giving light enough to read by at a distance of three-quarters of a mile, making the moon look as blue as an ordinary English sky, its golden gleam changed to a vivid rose-colour, lighting up the whole of the vast precipices of that part of the crater with a rosy red, bringing out every detail here, throwing cliffs and heights into huge black masses there, rising, falling, never intermitting, leaping in lofty jets with glorious shapes like wheatsheafs, corruscating, reddening, the most glorious thing beneath the moon was the fire-fountain of Mokuaweoweo."

On the east flank of Mauna Loa, about 4,000 feet in height, is the crater of Kilauea, which, Miss Bird says, has the appearance of a great pit on a rolling plain.

"But such a pit! It is nine miles in circumference, and its lowest area, which not long ago fell about 300 feet, just as ice on a pond falls when the water below it is withdrawn, covers six square miles. The depth of the crater varies from 800 to 1,100 feet in different years, according as the molten sea below is at flood or ebb."

We wish we had space to quote Miss Bird's fearfully vivid description of what she saw during the two visits she made to Kilauea, descriptions which, were they not evidently written on the spot with a truthful pen, would almost deserve to be called sensational.

She also made the ascent of Mauna Kea, to the north of Mauna Loa, the highest peak in Oceania, perpetually covered with snow, a dead volcano, whose top consists of deep soft ashes and sand.

On the west side of Hawaii is another extinct volcano, Hualulai, 10,000 feet high, which has only slept since 1801, when there was a tremendous eruption from it, which flooded several villages, destroyed many plantations and fish-ponds, filled up a deep bay twenty miles in extent, and formed the present coast.

The largest extinct volcano in the world, Haleakala, is in the centre of the island of Mauai, lying to the north-west of Hawaii. It is 10,200 feet in height; its terminal crater is nineteen miles in circumference, 2,000 feet deep, and contains numerous subsidiary cones, some of which are 800 feet high. Miss Bird of course visited it, and, as usual, her description is exceedingly graphic and full, and is considerably helped out by an excellent map of the crater. It seems that very few of the usual volcanic products are present in this extinct crater.*

Volcanic action in the Sandwich Islands would seem to have died out from west to east; this is inferred from the state of the lava and the great depth of soil in some of the western islands, as in Oahu and Kauai, the latter the most westerly of the inhabited islands. Some very remarkable instances of the powerful effects of weathering in causing degradation are to be seen in this island. The Punchbowl, a crater behind Honolulu, was in 1786 observed to be composed of high peaks; but atmospheric influences have reduced it to the appearance of a single wasting tufa cone; and the cone of Diamond Hill, to the south of the town, is also, from the same causes, rapidly diminishing.

The native population of the Sandwich Islands, which belongs to the Malay or Malyo-Polynesian division of Oceania, is fast dying out, at the fearful rate of something like 1,000 per year; so that unless some counteracting circumstances intervene, it must in a very few years become entirely extinct. Cook calculated the population of the islands in 1778 to be about 400,000; now the native population is under 50,000. That the decay is to a considerable extent owing to contact with whites there is no doubt.

But when every allowance is made for the effects of such contact upon the native population, it is questionable whether this will account completely for its rapid decrease. A similar decrease seems to be going on all over the Pacific islands, even in places where the whites have always been extremely few. From this point of view M. Leborgne has recently turned his attention to the small Gambier group, which consists of four islands. Magarévа, the most important island, had in 1840 a population of 1,130; it is now only 650. Dr. Hamy, in an article in *La Nature*, ascribes the prevalent diseases mainly to consanguineous marriages, a cause which is likely to obtain in many of the other isolated Pacific groups. This may have something to do with the diminution of the Hawaiian population, as also the fact that the careless, happy, and extremely sociable people seem to be almost devoid of anything like parental affection, taking little care of their children, and readily parting with them to anyone willing to take them; the consequence is that a large proportion die in infancy. Another point to be noted is that in 1872 the males exceeded the females by 6,400 souls.

At all events there is no doubt that the populations of most of the Pacific islands are rapidly disappearing, and that ere very long the only tenant of their lovely homes will be the omnipresent white man, who has foisted on them an exotic civilisation which seems to have unmanned them, to have completely checked their natural development, and whose invariable concomitants have been disease and widespread destruction.

We again recommend Miss Bird's most attractive book to the favourable notice of our readers. A small map of the islands is prefixed, and the few illustrations are beautifully executed.

* According to Mr. Brigham, the products of the Hawaiian volcanoes are native sulphur, pyrites, salt, sal ammoniac, hydrochloric acid, hematite, sulphurous acid, sulphuric acid, quartz, crystals, palagonite, feldspar, chrysolite, Thompsonite, gypsum, solfatarite, copperas, nitre, arragonite, Labradorite, limonite.

OUR BOOK SHELF

Sun and Earth as Great Forces in Chemistry. By Thos. W. Hall, M.D. (London: Trübner and Co.)

THE author of this work, professing himself the preacher of a new doctrine, theorises, to use his own words, "on the phenomena of chemistry . . . considering the whole of chemistry as but heat acting on matter." The sun is considered to exert some subtle chemical influence on matter, but, unfortunately for science, these effects, we are told, cannot be studied experimentally, "yet we can do so theoretically to a very useful extent." After carefully perusing the twelve chapters in which this eminently theoretical treatment is carried out, we are driven to ask ourselves whether Dr. Hall's views are not more of the nature of complication than of explanation. It may be safely affirmed that the phenomena of chemistry are far more easily explained by existing theories—imperfect though they be—than by the obscure reasoning based on perfectly gratuitous assumptions in which the present

volume abounds. Neither is the work free from the grave charge of inaccuracy. The writer who speaks of the sun as an "everlasting, universal, equable heat source," cannot be acquainted with Sir Wm. Thomson's paper on the dissipation of energy. On page 37 the equivalent of iodine is stated to be 125; on page 46 we are told that potassium is negative to sulphur. It will be new to our readers to learn (p. 50) that "attraction in chemistry does not differ from that in physics," and that carbon disulphide is prepared (p. 52) by powdering, mixing, and heating carbon with sulphur. On page 108 we are informed that "latent heat is, by the study of galvanism, resolvable into electricity." We do not differ from Dr. Hall in considering the following idea of the cause of electro-magnetism as "most rudimentary and rough." Speaking of a solenoid, the author states (p. 116), "Such a solenoid or its latent-heat current will avoid the latently hot parts of the earth—that is, her equator—and will place itself at right angles to the equator—that is, move away from the equator as far as it can; will, in fact, assume a position parallel to the magnetic meridian of the place, &c." The phraseology adopted by Dr. Hall must be characterised as eminently original; we select a few expressions to submit to the judgment of our readers:—"Proto-metalloidations," "nitridations," "hydro-soluble," "tensified, unmorphigenic electroid," "disoccupied," "very unnegative hydrogen," "hydrohalogenic acid," "equo-terro-solar equilibrium," "protometalloidid," "disequilibrium." The description of the combustion of carbon is perhaps worth quoting entire:—"Carbon combines with oxygen, leaves its solid shape for a gaseous one, forming carbonic anhydrid gas, and this greatly because of carbon's own heat constitution; and, further, because of the intense nearness of the oxygen to carbon and our earth's comparative distance; this because also of the excellent heat capacity of oxygen itself: and thus carbon with oxygen leaps up into carbonic anhydrid gas, earth loosened into the highest sun forms, approaching that of oxygen itself, for the heat capacities of carbon are near those of oxygen: but the oxy-terric struggle for carbon is arduous; our earth has greatly in her favour her immensity, but then she is far off, and her forces decrease with distance; but even so, for freeing carbon from our earth's control, oxygen requires always, as we know, the further assistance of heat on carbon; we always, for oxy-carbonic combination, have to set fire to carbon." On p. 34 we are gravely informed that potassium, even under naphtha, is acted upon by sun and earth forces, and becomes covered with an "allotropic crust." The author then goes on to remark that this behaviour arises from the fact that free potassium is "not a child of nature or of our sun, but of furnace heat, and its equilibrium taken with furnace heat must become slowly changed to that of our sun." In the new theory a metallic protoxide is thus formularised: E_xM_1O, "in which E stands for our negative earth, and x for the part she takes in the action not quantitatively known"—we may venture to add, nor yet qualitatively. It would be as tedious as unnecessary to give further quotations in illustration of the manner in which Dr. Hall has handled his subject—the extracts given above will doubtless serve as a caution to readers intending to take up the book. The selections themselves will render further comment a work of supererogation.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

On the Building up of the Tone in the "Gamba" Organ-pipe

In considering the nature of this pipe, and in determining the relation of its air-reed and its air-column, one fact discovered in these investigations should always be borne in mind, that the pitch of the reed is dependent not on vibrating length, but on vibrating divergence—on the amplitude of the reed's motion. The pitch of the air-column is not necessarily the same as the pitch of the air-reed; they may be and often are at variance: and this pipe will afford a happy means of demonstration of the statement made in a previous letter, that the tone of every organ-pipe is dual. As regards the reed, whatever the modifications of length by height of mouth, of thickness by varied wind-way, or of strength by amount of wind-pressure, the final result is bound by this law of divergence. In the typical air-reed, any deviation from the direct line of force taken by the stream of air is the beginning of vibration; its highest possible rate of vibration begins existence on its least divergence from the direct line; consequently, its highest pitch is its inceptive tone at this stage or condition of untamed energy. The bass has always been considered the basis and commencement of musical tone; every relation of tones has been examined on that ground, and it has undoubtedly been the source of many errors, one might almost say in the nature of superstitions, so tenacious has been its hold, so blinding its influence on the perceptions. Tone has its beginnings in the highest activity, and descends to the lowest and slowest; the development of its mechanical relations proceeds by definite degrees, and the issue depends on the affinity existing between the pipe and the reed, both possessing definite form, power, and character, and blending these by law. The vibration of the aëroplastic reed is thus shown to be *isotonic, not isochronous;* the laws of its vibrations are identical with those of the things most like itself, of sound-waves, of light-waves.

It was my good fortune some time ago to have placed in my hands a specimen of a variety of "Gamba" devised by the famous organ-builder, Schulze, of Paulenzelle. The "Gambas" form a class of pipes variously constructed in scale, and they are so called from the quality of their tone imitating the old "Viol da Gamba" and its modern representative the "violoncello." The general characteristics of the class are—cylindrical pipe of comparatively slender scale, low-cut mouth, full-winded at foot, and slow in speaking; the slow speech is a necessity, and is caused by the wind being, as it is technically termed, "much thrown out;" that is, the line of force of the current of wind is set more outward than ordinarily, for without such arrangement the fundamental or ground tone of the pipe would not secure its hold; some harmonic would usurp possession; for the air-reed, being short in consequence of low mouth, and strong from excess of wind, would keep to harmonics as the "flute harmonique" does; the latter has a low languid (or interior level within the mouth), the "Gamba" has a higher languid in relation to the under lip, thus directing the stream at a more oblique angle to that level. The tone has decided introductory and transitive harmonics. Of their sequence, although but momentary, the ear conveys a clear impression to our consciousness. We call it a "stringy quality," and it is a very interesting inquiry how this peculiar pipe-tone is built up. The characteristic quality pertaining to all stringed instruments whose tone is elicited by the bow, does, we may well suppose, arise through a process bearing a close analogy to this.

It is a disadvantage, this slow speech of the "Gamba," often felt to be excessively slow. Most skilful voicing is needful to give sufficient time for the appearance of the introductory harmonics without too greatly delaying the fundamental, for it is a nice point to strike the mean between having the wind so much thrown out that the pipe will not speak any tone, and risking, by giving quicker speech, the sudden "flying off to the octave," with obstinate persistence not to descend.

Take note of this. If you hold your hand or your finger near the mouth of any speaking organ-pipe, there is forthwith a sensible flattening of its pitch, deepening with the nearer approach of the hand; in tuning organs it is the ordinary custom to test pitch by this simple method, determining thereby whether the pipe will best bear flattening for its nearer approximation to a desired pitch or concord with others. Suppose yourself to be tuning a set of "Gamba" pipes: you would notice perchance that a restive pipe continually darting off to harmonics would be corrected and steadily held in check so long as your hand or finger was near or across its mouth. We can thus well understand how it might occur to Schulze that the temporary expedient could be made permanent. This is what Schulze did: he fixed a small bar across the mouth. The device proved successful. In pipes thus treated the tendency of the reed to settle at the octave is suppressed, speech is quickened, more wind may be given without danger, and the quality becomes in con-

sequence more characteristic, more "stringy." Schulze has extended his method to large pedal pipes, producing a stop of remarkable beauty, called the "Violone."

Applying the air-reed theory to this Schulze's "Gamba," we shall see how fruitful it is in illustration of the actual process of tone-making. Without diagrams and with but few technical terms it may be made clear and comprehensible. Let us take a specimen-pipe. It is of slender, graceful proportions, what is called "narrow scale," length thirty-seven inches and a quarter, diameter one inch and five-eighths, mouth or *embouchure* in breadth one inch and a quarter, and three-eighths of an inch high, and its pitch answers to the note E in the tenor octave. It has a very fine wind-way, large foothole, and is considerably overblown, for it will bear it. There is a bar in front of the mouth, fixed upon the little upright strips projecting at the sides about a quarter of an inch, which are termed ears; they are common to pipes until the size is too small to require it. Builders say the ears are added to pipes to steady the tone. On the theory advanced in these papers, we find their purpose is to prevent any flank movement of the atmosphere during the vibration of our air-reed, for the angle formed by the vertical line of the mouth and the line of force of the outwardly inclined stream of air presents an opening of weakness, and these ears are as ridges or outworks thrown up to guard against any premature invasion by the external air which, as intimated in an earlier letter, pierces through at the proper time only, just under the edge of the upper lip.

We readily perceive that the "Gamba" pipe has three specialties: overblown wind, to give a stiffer reed; a low-cut mouth, as a provision for shortness of reed; and wind much thrown out as a means compulsory for ensuring a greater amplitude in the reed's motion,—the result of the combination being that the tone is rich in harmonics; harmonics precede the ground-tone, and follow it, and coalesce into it, and linger behind as though the last to quit the pipe. There is nothing more beautiful in all the varied wealth of an organ than a well-voiced "Gamba." Every tone suggests a symphony, many-tinted, autumnal. There is another remarkable feature peculiar to these—the artist can shade them with less depth of ground-tone and more varied and delicate hues in the harmonics, which nevertheless come out more brightly in the contrast, and compensate the ear with a new variety, toned with less body yet with equal fulness, through the heightening of the harmonic colour, and the more gradual blending of the whole.

In the pipe we are examining we shall find that the wind is not so much thrown out as in the older class of the species, and herein lies the real meaning of the difference, for by the agency of the bar an equal amplitude is enforced in the air-reed, but one of new form: and see how gracefully it is drawn,—yes, happily we can see, for the new form bears an impress highly significant. A little bit of paper deftly applied will enable us to watch the process of nature. Take away the bar, and the pipe will not sound its ground-tone—it is only able to produce its string of brilliant harmonics. Look at the air-reed: how minute a space it traverses whilst these high notes are thrilling in your ears. In substitute for the removed bar, now lay a small pencil across the mouth, and see how in coy consent the air-reed yields, comes out to you with a fine curve, and all the power of the pipe is affirmed coincidently with this visibly extended amplitude of the reed's motion. You can change it from one state to the other by this movable bar, and you have to notice that the reed is almost upright in stem, but bends over, arching at the tip,—notice also that the inward curve of the reed is less than the outward curve. The explanation of this influence will be quickly divined if you fully comprehend the way in which the reed builds itself up in a curve, leaning outward upon the external air: the air composing the reed issues from the wind-way in a dense stream; the particles are most compressed at the root, and gradually expand and become less energetic as they reach higher freedom—the velocity of the upward stream motion attracts the external air with force, strongly, to the root, bearing with lessened force on the less compressed portions higher up, and the gradation of force so manifested gives rise to the curve—the curve delineates the force, we may say the curve expresses the constant flow of the surrounding air to this diversified region of "least pressure," its impulses being in graduated power from root to tip. By the bar we interfere with the direction of this flow, concentrate it more on the lower portion of the stem, and shield the tip of the reed from its influence; the upper portion, having thus lost so much of its natural support, is bent by the outflowing nodal wave of the pipe in a more supple curve, and to an extent equal to the required amplitude for its pitch. The form differs now. The curve of the "Gamba" is not the same as the curve of the "diapason."

The distinct agency of the air-reed and the nature of the air-column in relation therewith being evident, the inference follows that the note produced is dual, consists of two unisonous notes blended into one sound. Quite unexpectedly the chosen pipe furnished me with the talisman to prove its truth. When the reed and the pipe are suitably mated, the union is one of perfect harmony; but the reed rules always: it may be sharp to the pipe, but the pipe can never be sharp to the reed, for on the first intimation of such the reed is roused, and starts forth to a tone of higher velocity. How slight a matter may derange the union of the reed and pipe. If we tease the pipe with this pencil, peace is disturbed. Our beautiful little "Gamba" is very sensitive and high-spirited, and cannot help letting us hear a little of the inner life of the home when things go a trifle wrong. There is one particular place across the mouth for the fixture of the bar: if, resting the pencil at the upper points of the projecting ears, you leisurely bring it down, you will hear the changing harmonics; then, halting just a hair's breadth or so before the true position is arrived at, all tone will be lost, and there will suddenly break forth a wailing "who-hoo, who-hoo;" that torture will continue until you relieve the suspense by moving the pencil another shade in descent, when the discord will resolve into the perfect tone, instantaneously, as two dew-drops when they touch melt into one. Precisely the same "who-hoo" as we hear when tuning two separate diapason pipes so nearly in tune that they are only a shade out of unison and just on the point of accord. The "Gamba" pipe and the reed were similarly at variance; the air-reed, not having quite yielded to the outward influence of the bar, was a trifle sharp to the pipe; the supernodal wave was too short and unable to effect a synchronisation with precision, and therefore the phenomenon of beats was manifested. We could have lengthened the supernodal wave and flattened the note by adding a portion to the top of the pipe, when concord would have followed, as it did by lowering the bar, for in tuning it matters not which note of two is altered to bring about unison; we might alter either pitch of pipe or pitch of reed; but by the lowering of the bar we flatten the reed, and cause thereby the descent of the node (then an uneasy fulcrum) and the lengthening relatively of the supernodal column. As a listener remarked "there was surely a fight going on inside," we settled it by favouritism, taking sides with the little "Gamba," and gaining the reed over, in concession of its strength for the sake of concord. That is the explanation as it suggests itself to me, practically, exhibiting how a strong reed drives the node higher up in the pipe, and a weak reed favours the opposite; thus determining the variations in the lengths of pipes of unisonous pitch, so long an unsolved problem.

Another point of some importance is also illustrated—that the earliest harmonics in the theoretical series may be out of tune with the fundamental. Here the introductory or transitive harmonics are, it is evident, all sharp to the ground tone, since the influence of the bar does not come into effect until its flattening power ushers in the fundamental; phenomena of this kind occur in other instruments mostly unacknowledged—it is admitted to be the case in the trumpet, which has No. 5 in the series flat, 7 still flatter, and 9 sharp. A diapason pipe will, however, exhibit the same in the small pipes of the higher octave; they may be blown to imitate exactly the clash of the trumpet.

As showing the essential nature of the curve of the reed under the influence of the bar, it is worth notice that in the earlier "Violone" stops thus treated a square-faced bar was fitted, but with not so good effect as when the rounded bar was adopted; and in the light of our explanation we see why it should be so, for the curve could not form itself truly. The best form of bar is that given by a split pencil, the half-round, with the flat surface outward. Many other points of interest will be dealt with in another letter, on the interior movements of vibrating air-columns.

The study of the organ-pipe in every mood of its behaviour will make untenable the elegant fancy of a promiscuous assemblage of pulses fluttering and clamouring at the lip of the pipe, one of which out of a thousand it selects. It is a fair-seeming explanation, and under the commanding name of Prof. Tyndall generally accepted, for nothing better had been devised in philosophy. Not too strictly interpreting an ideality of expression, there yet remains an implied theory which is not in any sense borne out by the teachings of experience. The artist has some prescience of the powers that are to work his will; in practice

there is nothing adventitious; the pipe is a mechanism designed to a precise end which it fulfils; it speaks but as it must; there is no selective power, for the hand that fashions it, ordains.

HERMANN SMITH

Periodicity of Rainfall

IN his second letter (NATURE, vol. x. p. 263) Governor Rawson makes the following remarks:—"Mr. Meldrum, in his letter (vol. viii. p. 547), writes, that I have '*taken* 1846 *and* 1871 *as middle maxima years* [*in my first paper I also took* 1848], *whereas* 1849 *and* 1872 *are probably more correct*.' Mr. Meldrum is in error as to my having taken 1846 as a middle maximum, as a reference to my former letter will show. . . . I demur to the changes to 1849 and 1872: to the first because, without any sufficient reason, a dry year (48·10 in.) is discarded, and a wet year (67·88 in.) is added; and to the second, not because it affects my calculations, but because no reason is given."

In reply, I beg to observe that 1846 is either a misprint for 1848, or that in my manuscript 6 was inadvertently written for 8. This, I submit, is evident from the words immediately following the mistake, namely, "in my first letter, *I also took* 1848."

If Mr. Rawson supposes, or if his remarks imply, that I made 1849 a middle maximum, to avoid the small rainfall of Barbados in 1847 (48·10 in.) and at the same time to take advantage of the large fall in 1850 (67·88 in.), in order to make out a favourable case, I beg to say that he is entirely mistaken; for long before I saw his rainfall returns, I had invariably taken 1849 as a middle maximum year. The only instance in which I took 1848 was, as I said, "in my first paper" read before the Meteorological Society of Mauritius on Oct. 10, 1872. In all subsequent papers on the subject, including one read before the Royal Society, 1849 was taken. Righty or wrongly, therefore, the Barbados rainfall has been subjected to exactly the same treatment as that of the British Islands, the Continent of Europe, India, America, &c.

Assuming a causal connection between sun-spots and rainfall, it seemed to me that the effects, if any, would be most apparent *about* the times of the turning-points of the sun-spot curve, and that a comparison of the rainfall of each maximum period of three years with that of each minimum period of three years, for a considerable time and space, would be a preliminary test of the hypothesis. The difficulty was to know the exact epochs of maximum and minimum sun-spot frequency, and at the same time the rainfall for equal periods on either side of them. If we had the monthly rainfalls, and knew in what month the maximum and minimum of sun-spots occurred, it would be comparatively easy to compare the rainfalls for equal times with respect to the epochs. But there was another point to be considered, namely, that a cause requires time to produce its effect.

According to Prof. Wolf 1848.6 was a maximum epoch; which, I presume, means that the turning-point occurred in August 1848; the figures, however, might mean six-tenths of a year after 1848, or August 1849.

Taking August 1848 for the maximum epoch, the strict course, in order to place the epoch at the middle of thirty-six months, would be to give the rainfall from the 6th of February 1847, to the 6th of February, 1850. But this could not be done. It was necessary to choose a *whole* year as the middle maximum year. And the reason why 1849 was chosen in preference to 1848 was, that the object being to find whether the periodic changes indicated by sun-spots had any effect upon rainfall, and time being required for a cause to produce its full effect, there was a presumption that the maximum rainfall would take place after the maximum of sun-spots, somewhat in the way in which the maximum diurnal temperature occurs, not at noon, but an hour or two after noon.

For a similar reason 1872 was taken as a middle maximum in preference to 1871.

This allowance of time for the supposed cause to produce its effect is, though apparently unintentionally, made by Mr. Rawson himself when he adopts 1844, 1856, 1860, and 1867 as middle years; for, according to Wolf, the epochs were 1844·0, 1856·2, 1860·2, and 1867·1, that is, if I mistake not, early in each year; so that nearly two of each of the three years taken come after the epoch, while only one of them precedes it. By taking 1849, therefore, as a middle maximum year, we come nearer to the conditions observed with respect to the other epochs than we should do by taking 1848.

Before proceeding to deduce a few results from Mr. Rawson's valuable "Report upon the Rainfall of Barbados," from 1843 to 1871, with a copy of which he has favoured me, I would remark that he has made apparently some oversights in his letter. For example, he says, with reference to a comparison of the rainfalls at Fairfield and Halton, "but the rainfall at Fairfield during the last three years . . . is 13·33 per cent. below that of Halton. Therefore 21·7 in. have to be added to the minimum average of 1843-45, which would increase the above excess of 10·6 in." But if the minimum average be increased by a percentage, would it not be well to increase also the maximum average of 1847-49 by the same percentage? If this be done, the excess is not altered in the least.

The earliest rainfall observations at Barbados, given by Mr. Rawson, were those taken at Fairfield from 1843 to 1850, after which there is a long blank. Now, the rainfall there during that period gives the following results:—

Min. years.	Rain.	Max. years.	Rain.
1843–45.....	163·7	1848–50.....	179·7

showing an excess of 16 inches in the maximum period.

The next earliest and most complete observations are those taken at Husbands; they commence with 1847, and have been continued without interruption. From them we get:—

Max. years.	Rain.	Min. years.	Rain.
1848–50.....	182·3	1855–57.....	188·1
1859–61.....	183·3	1866–68..	162·8
	365.6		350·9

which gives an excess of 14·7 inches on the maximum side.

The greatest number of inter-comparable observations for the longest period are those taken at the eight stations, Binfield, Henly, Husbands, Grand View, Oughtersons, Halton, Edgecumbe, and St. Ann's, from 1855 to 1868; and I find that they give a mean excess of 56·9 inches on the side of the years of maximum sun-spot.

I do not think that these results are *opposed* to the hypothesis which Mr. Lockyer and myself have put forward. As a matter of fact, the rainfall of Barbados, as given by Mr. Rawson from 1843 to 1868, bears out the hypothesis if we take 1849 as a middle maximum in place of 1848; and it is for others to judge whether the reasons that have been assigned for the change from 1848 to 1849 (not for Barbados alone, but generally) are valid.

But it may be said that the rainfall of 1871–73 was opposed to the hypothesis. I have not the rainfall for those years before me. Granting, however, that they show a very considerable diminution, the question arises whether the favourable result of twenty-six years (1843–68) are to be upset by the unfavourable results of three years (1871–73)? Have we not in meteorology many such exceptions to well-established laws?

The rainfall at 250 stations in different parts of the world has now been examined, and the results are so decidedly favourable that it is practically of no consequence whether the experience of Barbados is for or against the theory. I think the more the subject is examined, the more clearly will the law come out; but we must be guided by facts, and not hesitate to discard this or any other theory when unsupported by facts.

Mauritius, Oct. 15 C. MELDRUM

Ice-Caves

THE occurrence of snow and ice in an old mine during the month of June, mentioned by Mr. J. Clifton Ward in his interesting paper in NATURE, vol. xi. p. 309—to the accuracy of the greater part of which I can bear personal testimony—has a more exact parallel in the Alps than "a Swiss *glacier*," namely, a *glacière*. These remarkable caverns have been fully described by Mr. G. F. Browne in his able and pleasant work, "Ice-Caves of Switzerland and France;" and briefly by myself in "The Alpine Regions." Since the publication of that book I have seen others; and as one of these has never, I think, been described in any English work, I venture to take the opportunity of sending you a short account of it. It is in the Val d'Hérens, a short distance from Evolena, on the way to the Pic d'Arzinol, and is called the Pertuis Freiss. A slip or subsidence of part of a cliff appears to have cracked the rock and opened two joints, into one of which fissures one can descend. This is about four feet wide and generally some four yards high, the floor being a little below the level of the ground outside. The crevice comes to an end in about a dozen yards. Against the slightly sloping wall of rock rested some pendent sheets of ice, whose thickness rarely appeared to exceed three inches, and irregular patches of ice lay about the floor. The temperature of the air appeared to be a little above the freezing (unfortunately, I had

not a thermometer with me). It was a warm summer's day—July 23. The ice exhibited the usual prismatic structure, but the prisms seldom exceeded a third of an inch in diameter. I was informed that in winter it was choked up with snow. The other fissure also contained ice, but as it was less accessible, and seemed in no way different from the former, I did not enter it. The especial interest of this case is that it affords what I might call the most rudimentary type of a *glacière;* a natural ice-house, replenished every winter, and perhaps sometimes entirely cleared out during an unusually hot summer. The "Grotto" on Monte Tofana, near the Ampezzo Pass (which I have not been able to visit), is, I expect, another of this kind.

St. John's College, Cambridge T. G. BONNEY

[By a misprint "glacier" was put for *glacière* in the last paragraph of Mr. Ward's paper.—ED.]

The Morse Code

THE following mnemonical device may be of some use to young telegraph students, and others, who wish to commit the Morse alphabet to memory. There is, I believe, a device employed in the Government schools, but it gives one so little help that I lately jotted down the subjoined scheme for my own instruction.

Let the vowels *a e i o u* and also *s h* represent the dots, and the remaining letters of the alphabet the dashes in the Morse code: the word attached to each letter will then express the signal for that letter. These words must be learnt; a task rendered easy by their commencing with or containing the letter they signify.

A	· —	at	N	— ·	no
B	— · · ·	base	O	— — —	P.Q.R
C	— · — ·	cave	P	· — — ·	Apps
D	— · ·	die	Q	— — · —	Q.Q.E.D
E	·	E	R	· — ·	are
F	· · — ·	safe	S	· · ·	ass
G	— — ·	Gnu	T	—	T
H	· · · ·	hush	U	· · —	Usk
I	· ·	is	V	· · · —	Asov
J	— — — —	Ujgj	W	· — —	awl
K	— · —	kit	X	— · · —	Faux
L	· — · ·	aloe	Y	— · — —	yawl
M	— —	my	Z	— — · ·	zwei

A few of the letters, *e.g.* J (the word for which might be regarded as a new way of spelling Ujiji), O, and Q, present a little difficulty, which some of your readers may lessen. As it is, these exceptional cases are so quickly impressed on the memory that the code thus learnt can be written in a surprisingly short time, and read soon afterwards. It is hardly possible the plan here suggested can be new, yet, as I have not met with anything similar, I venture to send it to you for publication.

W. F. BARRETT

The Micrographic Dictionary—Pollen Grains

AT present I have to do with the "Micrographic Dictionary" and the two other works mentioned in my letter printed in NATURE, vol. xi., p. 286. If the pollen grains of *Mimulus moschatus* are variable (as now stated by Mr. Cooke on the authority of Dr. Mohl), how is it that the figures and descriptions in the books mentioned are all alike? There is no variability here, but wonderful sameness both in illustrations and letter-press.

As the accuracy of my first simple observation has been called in question, I will add another. In the "Micrographic Dictionary," Pl. 32, Fig. 28, is given the pollen of *Sonchus palustris.* This, like that of the Mimulus, is totally wrong, the reticulation is by no means correct, and the abundant spines with which this pollen grain is clad (so common in the Compositæ) are totally omitted. Now, on turning to the Rev. J. G. Wood's book, Pl. 3, Fig. 24, this erroneous figure is reproduced with incorrect reticulation and no spines, and on referring to Mr. Cooke's work, Pl. 2, Fig. 6, the same errors are again perpetrated.

W. G. SMITH

OUR ASTRONOMICAL COLUMN

ζ^1 AND ζ^2 RETICULI.—These stars of about the sixth magnitude appear to offer a similar instance of large and nearly equable proper motion to the well-known one afforded by 36 Ophiuchi and 30 Scorpii, which was first pointed out by Bessel in the "Fundamenta Astronomiæ." If we compare Lacaille's positions (taking them from the reduced catalogue published by the British Association) with those given by the late Capt. Jacob from the Madras observations 1853-57, we find with the Pulkova precessions—

	R.A.	Secular Proper Motion. N.P.D.	Arc of great circle.	Direction of motion.
ζ^1 ...	+ 237″·5	− 74″·9	130″·3	54°·9
ζ^2 ...	+ 238″·7	− 79″·6	133″·8	53°·4

The introduction of Brisbane's places would only modify the above figures in a trifling degree.

When competent observers in the southern hemisphere are provided with heliometers for research on stellar aarallax, there will be no lack of objects to occupy their pttention, and we may expect most important results from such investigations.

THE BINARY STAR η CASSIOPEÆ.—We may very soon be able to make a fair approximation to the orbit of this double star, and so, with Mr. Otto Struve's value for the annual parallax, form some idea of the real dimensions and mass of the system, as is already the case with α Centauri and 70 Ophiuchi. An orbit given by Mr. Powell, of Madras, in vol. xxi. of *Monthly Notices*, R. A. S., is probably vitiated by typographical error or errors. Struve's parallax is o″·154 ±o″·045.

THE BINARY STAR α CENTAURI.—According to Mr. Powell's last elements, which are founded on measures up to 1870 inclusive, the components, at the present time, are nearly at their minimum apparent distance (1″·2), and the angle of position is advancing at the rate of 10° monthly. It may be hoped this fine object is receiving due attention from astronomers in the southern hemisphere at this critical period of the revolution. There would appear to be no probability of such difficulties attending observations at the passage of the peri-astron as those presented by γ Virginis in 1836, so far at least as can be judged from the measures to 1870.

RED STARS.—Amongst the red stars notified by the late M. Chacornac, is one which he estimated between the seventh and eighth magnitude, and of which he says, "éclat terne et nebuleuse." The position assigned identifies the star with No. 1172 of Rümker's Catalogue, whence for the commencement of the present year its right ascension is 4h. 16m. 16s., and polar distance 67° 19′·7. Rümker calls it a sixth magnitude, and Argelander (Durchmusterung) an eighth. Although different eyes will not always agree in estimations of brightness of the ruddy stars, there appears here to be a suspicion of variable light. Another of Chacornac's isolated red stars he himself indicates as variable. It is Oeltzen 21356, called 6 mag. by Lalande (No. 41453), 5·6 by Argelander, 5 in the Washington Zone, 1848, July 24; while Chacornac remarks, "sometimes brighter and sometimes fainter than a star of the seventh magnitude near it," which is probably Oeltzen 21386. Position for 1875, R.A. 21h. 17m. 5s.; P.D., 111° 22′·7. Neither of these stars is in Schjellerup's Catalogue, but that list is very far from being a complete one.

ENCKE'S COMET.—The extreme faintness of this comet at the present appearance is attracting the attention of astronomers who have had most experience of the circumstances of previous returns. Last week we quoted the remark of M. Stéphan on this subject, and we learn from him that he was using a newly polished mirror in the great Foucault telescope of the Observatory of Marseilles. In 1868 and 1871 the comet's appearance was very similar to what it had been in previous years under analogous conditions. In discussing the probability of any real change in the comet's constitution, it may, however, be well to bear in mind that in the year 1842, when the peri-

helion passage occurred on the same day of April, Encke was very doubtful of the comet being visible at all in this hemisphere, and had contented himself with transmitting an ephemeris to Greenwich, to be passed on to the Cape of Good Hope. It was only after Dr. Galle had detected with the Berlin refractor, on the evening of February 8, a very faint nebulosity within 2′ of the predicted position of the comet, that Encke communicated the ephemeris to the *Astronomische Nachrichten* (see No. 443). In 1842, on March 23, the comet was seen "distinctly in the twilight, with the moon shining brightly." At the beginning of the second week in April the condensation of light was very great, and a fine bright point was remarked: it was not seen in Europe after the 9th of this month.

*BEARING OF METEOROLOGICAL RECORDS ON A SUPPOSED CHANGE OF CLIMATE IN SCOTLAND**

IT is a belief very generally entertained that the climate of Scotland has undergone considerable change in recent years, the summers being less hot and the winters less severe than they used to be. This idea was advocated by Mr. M'Nab in his presidential address to the Edinburgh Botanical Society in November 1873, the facts adduced in support of it referring solely to vegetation. In this paper the question is examined exclusively from a meteorological point of view, and the examination is confined to monthly mean temperatures.

The following are the records which have been made use of:—1. Monthly mean temperatures from observations made at Gordon Castle, Banffshire, from July 1781 to November 1827; 2. The monthly temperatures given in Forbes' climate of Edinburgh (Trans. Roy. Soc. Edin., vol. xxii. p. 335); 3. Observations made at Dollar from 1836 to 1856, and from 1861 to 1874; and 4. Observations made at Elgin from 1855 to 1874. The mean temperatures of the months and the year were calculated for each of these four series of observations for the interval embraced by each, and then the differences of each month's mean temperature from the general mean for that month and station were set down in a table. Since the time over which each of these series of observations extended was sufficiently long to give a very close approximation to the true mean for the hour of observation and exposure of the thermometers, and since the separate months were only compared with the means for that place, the table may be regarded as representing very closely the *monthly variations* which have occurred in the temperature of Scotland during the past ninety-four years. It may be noted that the observations were made in two districts, viz., Gordon Castle and Elgin in the north, and Edinburgh, Dunfermline, and Dollar in the south.

The variations of each year, and of each month of each year, were then projected in curves, showing graphically the fluctuations which have occurred during this long period. The coldest year was 1782, being 3°·3 under the average, the deficiency of May of that year being 6°·7, and August 5°·9; then follow 1799 and 1816, being 2°·3; 1838, being 2°·0; and 1860, being 2°·4 under the average. The two warmest years were 1794 and 1846, the excess being respectively 2°·7 and 2°·9. During the nine years from 1787 to 1795, the temperature was generally above the average; the mean annual excess of the nine years being 1°·5. For the next quarter of a century temperatures were generally under the average. From this period to the present time there have occurred five fluctuations in the annual temperature above and below the average, differing in amplitude and duration, but giving no indication of a steady permanent change either way. Exceptionally warm and exceptionally cold months are distributed over the period in such a manner as to show that substantially no permanent change has taken place in the temperature of any of the months.

Since, however, the eye may not be able easily to detect any steady rise or fall that may be going on owing to the sharply serrated character of the curves, other averages were calculated on the method of taking as the average of, say, January 1784, not the average of that year, but the average of the five years 1782, 1783, 1784, 1785, and 1786. All the averages were dealt with in this way, and the results projected in a set of thirteen new curves. From these consecutive five years' averages, it is seen that mild Decembers prevailed from 1787 to 1797, from 1822 to 1845, and from 1862 to 1867; and cold Decembers from 1798 to 1821, from 1846 to 1861, and from 1868 to the present time. It may be noted that in 1821 the remark might have been made from the previous forty years' observations, that the character of Christmas weather had undergone a great change, the Christmases of the latter part of the period being generally much more severe; and again, in 1843, looking at the long period of forty-seven years, beginning with 1796, it might have been said that the old-fashioned Christmas weather had almost ceased to occur in the latter half of this long period, and that the climate had undergone some great permanent change. Now, while both would have been right as to the facts (whether these facts were based on numerical data or on recollections), both would have been wrong in inferring a permanent change, even though the inference was based on the observations of half a century. Looking, however, at the ninety-four-years' period, we can only conclude that the weather of December, as regards temperature, is subject to large fluctuations, which differ both in intensity and duration, and that there is no tendency to a permanent increase or decrease.

One of the most interesting features of the curves is the similarity existing among them *inter se*. The curves for August and September closely resemble each other, as also do those for November and December, while that for October combines the main features of the two sets. The curve for January combines the main features of the curves for November and December on the one hand and February and March on the other, and so on with the other months.

The general result of the inquiry then is, that though large annual fluctuations of temperature have occurred, yet the warm and the cold cycles, extending over longer or shorter periods, are so distributed over these long intervals as to give no indication that there has been any tendency towards a steady increase or decrease in the temperature, or that any permanent change has taken place in the climate of Scotland. And since the same remark applies with equal force to the observations of the separate months, it follows that meteorological records give no countenance to the idea of a permanent change having occurred in the climate of Scotland either as regards summer heat or winter cold. It may be added that during the past seven years the temperature of July has been above its average respectively 2°·8, 1°·7, 2°·0, 0°·2, 1°·7, 1°·0, and 1°·8, and that of December, as compared with its average + 1°·5, − 4°·2, − 5°·6, − 1°·1, − 0°·8, + 3°·4, and − 7°·4; results quite in the opposite direction of the popularly entertained belief that the summers are colder and the winters milder than formerly.

ALEXANDER BUCHAN

* Abstract of a paper read at the General Meeting of the Scottish Meteorological Society, held on 10th Feb.

NATURAL PHENOMENA IN SOUTH AMERICA *

THE following notes may, I hope, possess some interest for the readers of NATURE. They were made during an expedition which took place last,

* Notes of some observations made by a telegraphist during a cable-laying expedition from Pará to Cayenne.

summer, when a cable, designed for the Company by Sir William Thomson and Prof. Fleeming Jenkin, and manufactured by Messrs. Hooper, was laid by the large new telegraph ship *Hooper* between Parà and Cayenne on the coast of South America.

1. *Aspects of the Forests—Unconscious Action of the Sensorium.*—One of the first things which strikes a person at anchor in the Parà River is the increased clearness with which he can distinguish the details of the distant forest on the river's banks after he has repeatedly, but it may be unconsciously, looked at it. At first the forest presents the appearance of a vague dark-green wall uprising from the brimming yellow flood of the river, but by and by the eye clearly traces boughs, shapes, and even differences of tint in the foliage, which before had entirely escaped its observation. It seems, indeed, as if it were true sensitively as well as intellectually, of the eye as well as of the imagination, that "the oftener we looked at things the more we saw in them." It seems as if, within certain limits, the image of an object became more distinct in our consciousness the oftener it impressed itself on the retina, or that our perception became, unconsciously to us, more acute the oftener it was exercised upon the same object. This appears to be true also of the other senses; for example, a chemist has to smell or taste some time before he can discriminate the ingredients of a mixture, and the peculiar cries of the street vendor in time become intelligible to us without any apparent effort on our part.

Within the forests the absence of grass is at once noticeable. The only plant, indeed, resembling grass, is an orchid which grows as if it had been merely tossed up into the trees. It is very like that sharp-edged sword-bladed grass so troublesome to the farmer and difficult to eradicate from his field. The absence of grass may be attributed to the great evaporation and non-retentiveness of the soil, or to the deep shade of the thick underwood.

In the vicinity of Parà I noticed two trees of different species so entirely locked together as to have one common trunk for seventy or eighty feet of altitude. Near Lake George, in North America, there is, I believe, a similar phenomenon, of which the guide, who points it out, wisely remarks, "Whom God hath joined, let no man put asunder."

2. *Thunderstorms.*—Another thing which cannot fail to "strike a stranger" is the prevalence of lightning at Parà. There is a display usually every afternoon. The locality seems to lie between that city and the mouth of the river. Thunder is rarely audible. The flashes are large and of a flame-colour, and proceed out of widespreading dark clouds. It was my good fortune to witness a rain and thunder storm on a large scale there. At every flash a bluish glare suddenly illumined the broad river even to the opposite shore, the flooded streets, the piles of buildings, and the shipping so distinctly that each rope and spar might have been numbered. The flashes succeeded each other with marvellous rapidity, but were not in every case accompanied by audible thunder.

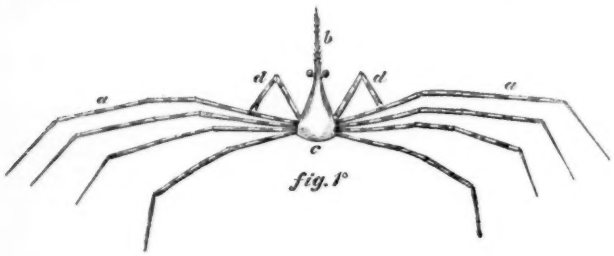

fig. 1°


fig. 2°

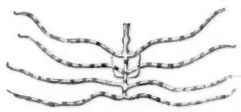
fig. 3°

3. *Flying Fish, "Portuguese men-of-war,"* and some other floaters, were seen most frequently in the morning. The Portuguese man-of-war is then very difficult to distinguish amidst the general unrest of the slate-coloured waves. He is usually found solitary, or with a single companion, in the fleet to which he belongs. I was surprised to find that the larger ones were, however, frequently accompanied by a school of little fishes like sardines, which twinkled around them in the water like so many attendant sprites. Their object in being there was doubtless to get food, but how this is done it is difficult to know.

The flying-fish were sometimes extremely numerous. They turned both horizontal and upward vertical curves in the air during their short flight, which resembles that of a mud-lark. It seemed to me that they vibrated their wings rapidly on first starting, so as to assist them to gain a sufficient height, after which they simply skimmed till they touched water again and gave themselves a fresh impulse. Their wing-power is certainly, as yet, unable to sustain flight, although it is capable of assisting and diverting it.

4. *A Barracouta.*—In the River Parà estuary a fine lusty Barracouta leaped from the water into the ship, a height of ten or twelve feet, nearly striking our chief engineer in the face. He caught it. The back was beautifully chased with dark-green, blue, and gold; the sides and belly with paler green, blue, and gold; and three rows of metallic-looking spots were ranged along the sides like flakes of citrate of iron and quinine. It had a single row of sharp triangular teeth in each jaw.

5. *Phosphorescence.*—This phenomenon was sometimes very beautiful. It owes its appearance, perhaps, not so much to conditions of atmosphere, &c., as to prevalence of the creatures which give rise to it. We remarked the boundaries of a thick colony of them as clearly defined amongst the surrounding population as land is from sea on a map. The usual appearance of this phosphorescence and of the flight of flying-fish are accurately described by the Rev. Canon Kingsley in "At Last."

6. *St. Roque Current.*—We found the speed of this current to be as much as four knots an hour sometimes, instead of two and two-and-a-half as marked on the charts. In lat. 3° 42′ N., long. 48° 15′ W., we found it skirting the edge of the fringing reef, and so well defined from the rest of the ocean, that in crossing it the ship was half in current water and half in ocean, and the agitation at the line of demarcation could be seen for miles. At the surface we found its temperature to be 82° F., and at the bottom, 150 fathoms deep, we found the temperature only 59° F.

7. *Live Specimens.*—Off the mouth of the Amazon we had occasion to pick up some cable which had been submerged a little over a month. In the vicinity of the lightship, among the sandy shoals of the River Parà estuary, the cable was completely encrusted with tiny barnacles. Beyond this, and further out at sea, it came up covered with submarine vegetation, crabs, and shells of curious description. Among the latter were a pink, semi-transparent Leda, with onyx-like streaks of white; and a nummulite. The seaweeds were in great variety

clinging to the cable, sometimes in thick groves of red and yellow algæ, slender, transparent, feathery grasses, red, slimy fucoids, and tufts of amethyst moss. We found branching coral plants, upwards of a foot in height, growing on to the cable, the soft skeleton being covered with a fleshy skin, generally of a deep orange colour. Sometimes a sponge was found attached to the roots of these corals, and delicate calcareous structures of varied tints encrusted the stems of all these plants, and served to ornament as well as strengthen them. Parasitic life seems to be as rife under these waters as it is on these shores. Many star-fishes, zoophytes, and curious crabs were likewise pulled in, clinging to the cable. The latter were frequently completely overgrown with the indigenous vegetation of the bottom, or of the colour of the sand there, and so were scarcely distinguishable from it. Others, although not so covered, were found to have the same tints as the vegetation they inhabited, and even in structure resembled the latter somewhat. Others, again, were perfectly or partially transparent; and one most beautiful creature, perhaps new to science, united singularly enough in its person several prevailing colours of the bottom. Its slender limbs (Fig. 1), like jointed filaments of glass, were stained here and there of a deep topaz brown (*a*). Its pointed snout (*b*) was of a deep scarlet; its triangular body (*c*) of a light yellow; its eyes were green, and its tiny hands (*d*) an amethyst blue.

Another very active crab or water-beetle was also picked up. It was quite transparent, and had bright green highly convex eyes (Fig. 2).

Another creature (Fig. 3) of quite a different description was also picked up. It was more like a water-spider than anything else. Its transparent hair-like limbs were dappled with dull green, and it seemed a mere skeleton

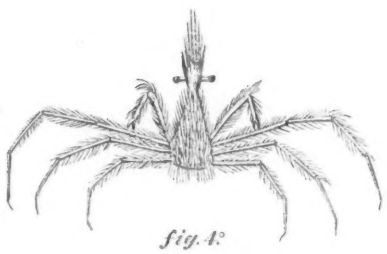

fig. 4.

framework made to carry a small white sac containing entrails, which was slung underneath. These three distinguished specimens were entirely free from parasitic weeds, and were the only ones of their kind observed. Many crabs (Fig. 4), generally resembling Fig. 1 in shape, but altogether ruder in form, were found in plenty, all bearded with moss in the manner shown. While looking at these frail organisms, one was forced to conclude that there must surely be little disturbance in their habitats.

The temperature varied from 79° F. in the deeper water to 83° F. in the shallower. The cable was most thickly encrusted with vegetation in depths of thirty to forty fathoms, and there was a very sensible falling off when the depth reached sixty fathoms, and the water became salter and more free from silt.

The specimens, Figs. 1 and 2, were found in water of thirty and forty fathoms respectively, about lat. 0° 55′ N., long. 48° 8′ W., off the coast of Marajo, or Joannes Island.

The specimens, Figs. 3 and 4, were found in water of sixty fathoms, sixty miles off the coast, about lat. 2° 56′ N.

The few unlucky waifs observed of the many which came up are at least sufficient to hint at the wonderful variety of submarine life there may be in the littoral zones of these regions, which are well worthy of being examined by naturalists; and picking up cables suggests a novel way of dredging for them.

8. *Fishes' Bites.*—The cause of our picking-up operations is in itself worthy of remark. We found that the cable had been bitten in several places by fishes powerful enough to displace the iron sheathing and pierce the cable to the core with their teeth, pieces of which we found sticking in the bitten places. There is reason to believe that the electric current had given them a shock and caused them to quit their morsel rather hastily. The bites were all located in the cable off the Delta of the Amazon, and had undoubtedly taken place when the cable was freshly laid, and before it was rendered inconspicuous and unattractive by the submarine fauna and flora.

J. MUNRO

THE BIRMINGHAM COLLEGE OF SCIENCE

SOME months ago we intimated that Sir Josiah Mason had set aside a munificent sum of money wherewith to erect and endow a College of Science in Birmingham. On Tuesday last, his eightieth birthday, the donor laid the foundation-stone of the building, in presence of a large gathering, composed of representatives of various public bodies.

We have already given some details of Sir Josiah Mason's scheme, which appears to us exceedingly judicious, liberal, and comprehensive. The entire sum to be spent by the wise and generous founder will amount to upwards of 100,000*l.*, of which 65,000*l.* will be reserved for endowment. The plan of education comprises courses of instruction in mathematics, abstract and applied; physics, both mathematical and experimental; chemistry, theoretical, practical, and applied; the natural sciences, especially geology and mineralogy, with their application to mines and metallurgy; botany and geology, with special application to manufactures; physiology, with special reference to the laws of health; and the English, French, and German languages. The course of study may also, in the discretion of the trustees, include such other subjects of instruction as will conduce to a sound practical knowledge of scientific subjects, excluding mere literary education. It is provided that popular or unsystematic instruction may be given gratuitously or by fees in the discretion of the trustees, and shall be open to all persons without distinction of age, class, creed, race, or sex. Theology and theological or religious subjects are absolutely excluded from the curriculum. Students must be between the ages of fourteen and twenty-five, and must pass such preliminary examination as the trustees may direct. In exceptional cases, students above twenty-five will be admitted; but these must not exceed the proportion of one to ten. The founder has decided that a certain proportion must be selected on grounds which are reasonable and not too narrow. The original trustees are Mr. W. C. Aitken, Mr. J. Thackray Bunce, Dr. Gibbs Blake, Dr. Heslop, Mr. G. J. Johnson, and Mr. George Shaw, and the Town Council of Birmingham is empowered to appoint five additional trustees after the death of the founder. The building, which is in the early pointed style, from designs by Mr. J. A. Cossins, architect, of Birmingham, will occupy an area of about an acre, with frontages on either side of 149 feet and 127 feet respectively, in the immediate vicinity of the Town Hall, the Midland Institute, and the new municipal buildings.

After the ceremony of laying the foundation-stone, a meeting was held in the Queen's Hotel, at which, among others, Mr. John Bright was present, and paid a deserved tribute to the far-seeing liberality of the founder of the College. Sir Josiah Mason himself, in an address marked by moderation and great sagacity, gave a simple account of his own career, in which he has amassed a fortune by patient industry, and spoke with great emphasis of the

difficulties which he and his contemporaries had to encounter in their youth from the want of any means of carrying on their education, especially in science, during the intervals they had to spare from work. The aims which he has in view in founding the College may be gathered from the following extract from his address :—

"Whatever is necessary for the improvement of scientific industry and for the cultivation of art, especially as applied to manufactures, the trustees will be able to teach ; they may also, by a provision subsequent to the original deed, afford facilities for medical instruction ; and they are authorised, and indeed enjoined, to revise the scheme of instruction from time to time, so as to adapt it to the requirements of the district in future years, as well as at the present time. It is not my desire to set up an institution in rivalry of any now existing ; but to provide the means of carrying further and completing the teaching now given in other scientific institutions and in the evening classes now so numerous in the town and its neighbourhood, and especially in connection with the Midland Institute, which has already conferred so much benefit upon large numbers of students, and which I am glad to see represented here to-day. My wish is, in short, to give all classes in Birmingham, in Kidderminster, and in the district generally, the means of carrying on, in the capital of the Midland district, their scientific studies as completely and thoroughly as they can be prosecuted in the great science schools of this country and the Continent ; for I am persuaded that in this way alone—by the acquirement of sound, extensive, and practical scientific knowledge—can England hope to maintain her position as the chief manufacturing centre of the world. I have great and I believe well-founded hope for the future of this foundation. I look forward to its class-rooms and lecture-halls being filled with a succession of earnest and intelligent students, willing to learn not only all that can be taught, but in their turn to communicate their knowledge to others, and to apply it to useful purposes for the benefit of the community."

Thus it will be seen that Sir Joseph Mason's design has been conceived in a spirit of true wisdom ; he perceives that the prosperity of Birmingham, like the prosperity of the country at large, depends upon the extent to which every branch of history is founded upon a broad and deep scientific basis. He evidently does not intend that his institution will become a mere "Technical" College. We should think that the trustees will carry out the design and wishes of the founder if they aim to make the Mason College do for Birmingham what the Owens College is doing for Manchester. Moreover, we hope that as in the case of Manchester other endowments will be added to that of the wise and generous founder, and that thus the trustees will be able ultimately to carry out his ideas to their fullest development. Meantime all who have the cause of scientific education at heart, all who wish for the highest prosperity of the country, will feel warm gratitude to and admiration for Sir Joseph Mason, a true benefactor to Birmingham, to England, and to Science.

NOTES

We can only, this week, express our regret—a regret which is universal—at the death of Sir Charles Lyell, Bart., F.R.S., which took place on Monday last. Sir Charles was born on Nov. 14, 1797, so that he was nearly 78 years of age. We hope to give an obituary notice in our next number.

We regret to announce the death, on Feb. 17, of the celebrated astronomer, Prof. F. W. August Argelander, at Bonn. He was born at Memel on March 22nd, 1790, and began his studies at the University of Königsberg, where he soon became a zealous pupil of Bessel, and in 1820 his official assistant at the Observatory. Three years later, he followed a call to Abo (Finland), and his principal occupation there was the observation of fixed stars showing large proper motions. These observations were continued at Helsingfors, where he settled in 1832. He succeeded in pointing out nearly 400 fixed stars, which in the time from 1755 until 1830 have moved over more than fifteen seconds in the direction towards the constellation of Hercules. In 1837, when his pamphlet "On the Motion of the Solar System" had appeared, he received an invitation from the University at Bonn, where an observatory was being built, which was completed in 1845. Here he continued his studies most energetically, and particularly investigated the variable stars. In his "Uranometria" he gave excellent determinations of star-magnitudes. His celestial atlas, which was only completed a little while ago, comprises all stars from the first to the tenth magnitude ; it is entirely based on his own determinations of position, and decidedly ranks amongst the best works of the kind.

An important telegram was received by the French Academy of Sciences, at its sitting of the 22nd February, from M. Mouchez, the head of the St. Paul Transit Station. It is said that the observation of internal contacts was perfectly successful. The external contacts were not good, owing to clouds, the weather having been bad for three months. Numerous photographs have been taken. A steamer had left St. Paul for Cherbourg, bringing the detailed results of the observations.

At the same sitting, M. Dumas announced that the Academy had received, almost at the same moment, two different parcels sent by two different ships, both consisting of documents sent by Capt. Fleuriais, the head of the Pekin Transit Expedition. These parcels, having been sealed, will not be opened for some time to come.

The following quaint extract from the *Gazetteer* of May 31, 1769, will no doubt have some interest for our readers at the present time :—"The Transit of Venus over the sun is a phenomenon whereby the astronomers can determine the distance of the sun from the earth, and the dimensions of the whole solar system, more accurately than by any other method. Such a transit will be visible near London on Saturday afternoon, June 3, a little after seven o'clock, if the weather be fair ; and never more for this age, nor perhaps for many ages to come, will such a phenomenon be seen in this quarter of the world. The curious, both ladies and gentlemen, who are desirous of being entertained with a sight of this phenomenon, may have the best situation for that purpose, with the assistance of proper persons and telescopes, at Mr. Lightfoot's, at Denmark Hall, on Camberwell Hill, in the road towards Dulwich, where the best of accommodations and wines may be had."

An official intimation has been received from Dr. Neumayer confirming the announcement, as regards the Deutsche Seewarte at Hamburg, contained in the *Times* telegram noticed in our last number. It appears that the Government have purchased Herr v. Freeden's interest in the establishment, and that he has no longer any connection with it. It does not yet appear what is the relation of the Hydrographic Office at Berlin, of which Dr. Neumayer is chief, to the Deutsche Seewarte, which is also under him.

A Society has been formed in Calcutta for obtaining spectroscopic observations of the sun.

We are much gratified to hear that the Committee of the Chester Society of Natural Science recommend for the consideration of the members that a permanent memorial to the late Canon Kingsley, their founder and president, be established. The memorial proposed and recommended is (1) That a Scholarship (including a medal), to be called "The

Kingsley Memorial," be founded for the encouragement of Natural Science, to be open to residents and students within the district embraced by the society, subject to such regulations as may be hereafter agreed upon. 2. That if a sufficient fund be raised, a medal may from time to time be given by the Chester Society of Natural Science, for original research within the district of the aforesaid society, and that the medal be called "The Kingsley Memorial Medal."

WE are glad to see from the report of the Syndicate appointed by the Senate of Cambridge University to organise and superintend courses of lectures and classes at a limited number of populous centres, that the scheme is working well and is embracing a rapidly widening area. In the first term of 1873-4, the number of towns which took advantage of the scheme was three—Nottingham, Derby, and Leicester. This number increased to seven in the following term, and to twelve in the first term of 1874-5. During the present term lectures and classes are being carried on in the following sixteen centres:—Nottingham, Derby, Leicester, Lincoln, Chesterfield, in the Midland district; Leeds, Bradford, Keighley, Halifax, Sheffield, in the Yorkshire district; Stoke-on-Trent, Hanley, Burslem, Newcastle-under-Lyme, in the South Staffordshire district; Liverpool and Birkenhead in the Liverpool district. The subjects on which the lecturers are giving instruction during the present term are Political Economy, English Constitutional History, English Literature, Logic, Physical Geography, Geology, Astronomy, Physical Optics and Spectrum Analysis. A course of lectures is generally concluded in one term, though occasionally it extends over a longer period. The term's course comprises the delivery of twelve weekly lectures and the holding of twelve weekly classes. During the present term the number of lecturers employed is thirteen; the total number of pupils attending the courses is about 3,500; and the sum payable to the University for the teaching, examination, and certificates is 1,150*l.* The Syndicate recommend the adoption of a standing Syndicate for the organisation and superintendence of the lectures. A gentleman in Nottingham has offered the sum of 10,000*l.*, to be placed in the hands of trustees, towards the furtherance of this object in that town, provided the Corporation of Nottingham will erect buildings for the accommodation of the University lecturers, to the satisfaction of the Syndicate of the University of Cambridge.

A SERIES of (Davis) Lectures upon zoological subjects will be given in the New Lecture Room, in the Zoological Society's Gardens, Regent's Park, on Thursdays, at 5 P.M., after Easter:—April 15, "Monkeys and their Distribution," by Dr. P. L. Sclater, F.R.S.; April 22, "Sea-Lions," by J. W. Clark, M.A.; April 29, "Seals and the Walrus," by J. W. Clark, M.A.; May 6, "Deer and their Allies," by Prof. Garrod; May 13, "Sheep, Oxen, and Antelopes," by Prof. Garrod; May 27, "Camels and Llamas," by Prof. Garrod; June 3, "Elephants," by Prof. Flower, F.R.S.; June 10, "Kangaroos," by Prof. Mivart, F.R.S.; June 17, "Pheasants and their Allies," by Dr. P. L. Sclater, F.R.S.; June 24, "The Locomotion of Animals," by Dr. Pye Smith. The lectures will be free to Fellows of the Society and their friends, and to other visitors to the Gardens.

WILLIAM PARKINSON WILSON, Professor of Mathematics at the Melbourne University, died suddenly on Dec. 11. He was Senior Wrangler in 1847, and a Fellow of St. John's, Cambridge, and arrived in the colony in 1855 as a member of the first professorial staff of the University, which he has zealously served ever since. The Professor was everywhere respected. He was, the *Times* correspondent states, at the head of all scientific movements, devoting himself energetically to anything which promised to promote the intellectual progress of the colony. The selection of his successor at the University is entrusted to Prof. Adams, of Cambridge.

A MUNIFICENT gift has been made to Melbourne University. Mr. Samuel Wilson, of Ercildoun, who recently gave 1,100*l.* to the Acclimatisation Society, has sent 30,000*l.* to the Chancellor, intended for the erection of a hall, but free of conditions, and to be otherwise applied if the authorities think fit.

THE Khedive has instructed Dr. Schweinfurth to organise an African Geographical Society in Egypt.

A GRANT of 50*l.* has been made from the Worts Travelling Scholars' Fund (Cambridge) to Arthur Marshall, B.A., of St. John's, to enable him to visit Naples for the purpose of using Dr. Dohrn's zoological station and making researches in natural history, with the understanding that he send specimens to the University, accompanied by reports.

ALPHA FIBRE, or Esparto Grass (*Machrochloa tenacissima*, Kth.), the closely compressed bundles of which are so familiar to us either in stack at wharves or in barges on the Thames, in course of transit to the various paper-mills, has created more than usual interest of late, owing to the report that the supply was becoming exhausted. In contradiction to this it is satisfactory to note, on the authority of Col. Playfair, the Consul-General at Algiers, that enormous tracts of land on the high plateaus in all the provinces of Algeria are covered with the plant. Thus, in the province of Algiers it covers an area of about 2,500,000 acres. In the province of Oran the extent of the Alpha growth is almost unlimited. In the circle of Daïa it is stated to cover a space of about 900,000 acres, while in the subdivision of Mascara there is an immense field for its exploration. In the several divisions of the province of Constantine it is estimated that a total of about 570,000 acres are under growth of this substance. These figures alone show an aggregate of some 3,970,000 acres of Esparto known to exist in Algeria. The difficulty, however, is in the want of proper roads or easy means of transport by which the material could be brought to the sea or a railway station. Col. Playfair says that practically there is no limit to the supply of Alpha procurable from Algiers; all that is required is the establishment of railway communication, and the Government of the colony is prepared to sanction the construction of lines, either by French or foreign capitalists, on the most liberal terms. Several companies have been formed for the purchase and exportation of this fibre, which is becoming more sought for in proportion to the increasing demand for paper. The Algerian authorities are quite alive to the necessity of encouraging all such commercial enterprises as may tend to develop this important branch of commerce.

IN a communication to the *Pharmacist* (Chicago) for last month, Mr. H. H. Babcock says he is convinced that *Cypripedium spectabile* and *C. pubescens* are capable of producing poisonous effects, on himself at least, similar to those caused by *Rhus toxicodendron*. He bases this statement upon the fact of his having experienced such symptoms after gathering the plants in question several seasons in succession. It seems scarcely possible that these plants, which have long been in cultivation in this country, possess the noxious properties attributed to them; the general properties of the family to which they belong are so different. However, one direct experiment might settle the question.

DR. ALLEYNE NICHOLSON, Professor of Biology in the College of Physical Science in Newcastle-upon-Tyne, has been offered and accepted the chair of Natural History in the University of St. Andrew's.

PROF. GABB reports continued progress in his geological and ethnological survey of the Talamanca district in Costa Rica. It may be remembered that Prof. Gabb was invited several years ago, by the Government of Costa Rica, to take charge of an investigation into the resources of the country, and certain reports of his operations from time to time have shown very

satisfactory progress. He has now accomplished the Talamanca survey, and will probably extend his researches into other parts of the country, particularly that bordering upon the Pacific coast, his previous explorations having been confined to the Atlantic slope. With only four assistants besides Indian labourers, Prof. Gabb has surveyed the entire tract, of about 3,000 square miles, from the borders of civilisation on the north to the borders of Panama, and from the Atlantic to the crest of the Cordilleras; and this he has mapped out more accurately than any other equal area of Costa Rica has been surveyed, not excepting the section where the towns are situated. He also gives reliable information and statistics about an agricultural country sufficiently large, fertile, and healthful to support the entire population of Costa Rica, but which as yet contains only 1,226 Indians and twelve foreigners, of whom only one is white. It is watered by one river, which is navigable throughout the year, and which reaches within thirty miles of the most remote portion of a country valuable for agricultural purposes. In addition to the survey proper, as referred to, information has been gathered in regard to the mineral resources of the region and its animal and vegetable life, immense collections of both, as previously stated, having been sent to the Smithsonian Institution for identification. Among the number are one hundred specimens of monkeys alone, while the other mammals, birds, &c., are in due proportion. The exhaustive inquiries prosecuted into the ethnology of the country have resulted in very rich collections, which have likewise been forwarded to Washington. Numerous vocabularies, with several dialects, have also been obtained, which offer much of promise to the philologist. It is greatly to be hoped that Prof. Gabb's inquiries may be continued, with Costa Rica as a base, until they include the whole of the unknown portions of Central America.

THE *Kölnische Zeitung* of Feb. 10 gives an account of Prof. Böhm's (Dorpat) researches on revival after cases of poisoning. He succeeded in reviving cats which had been poisoned by injection of potash salts into their veins, after forty minutes' duration of a state which was in no way different from actual death, the action of the heart and respiration having completely ceased. He obtained these results by artificial respiration and simultaneous compression of the breast in the vicinity of the heart. The professor points out the importance of the latter point, which he deems as essential as the action of the lungs. In any case his researches are of high interest for the relation they bear upon the revival of poisoned persons.

THE *Bohemia* reports extremely heavy snowstorms which took place in a part of Moravia and Bohemia on Feb. 5, and caused great damage to railways, several trains being thrown off the lines, luckily without much injury to passengers. At Znaim (Moravia) the storm was so violent at noon that it was impossible to see more than three yards ahead.

THE *Oberschlesische Volkszeitung* of Feb. 1 reports the discovery of some colossal remains of the Mammoth (*Elephas primigenius*) near Ober Glogau (Silesia).

THE *Neue Freie Presse* announces that Herr R. Falb, of Vienna, discovered a new variable star, near *i* Orionis, on the night of Jan. 31. The discovery was confirmed on the same night by Prof. Oppolzer at his private observatory, and on subsequent nights by the astronomers at the Imperial Observatory of Vienna. The star is visible with the naked eye.

PROF. ASA GRAY, in a paper in the February number of *Silliman's Journal*, on the question, "Do Varieties wear out, or tend to wear out?" comes to the conclusion that from the scientific point of view, sexually propagated varieties, or races, although liable to disappear through change, need not be expected to wear out, and there is no proof that they do; but non-sexually propagated varieties, though not liable to change, may theoretically be expected to wear out, but to be a very long time about it.

WE are glad to see that the Watford Natural History Society is now completely organised and fairly set a-going. At a recent meeting officers were elected, and a *conversazione* was afterwards held. The president chosen is Mr. John Evans, F.R.S., and Mr. J. Gwyn Jeffreys, F.R.S., is one of the vice-presidents. The first regular meeting is to be held on March 11, when Mr. J. L. Lobley, F.G.S., one of the members of the Council, will read a paper on "The Cretaceous Rocks of England."

ON the 10th inst., at six o'clock in the evening, a large aërolite was observed at Paris, in the department of the Marne, at Orleans, and at Belleisle en Mer. No noise was heard, but the display of light was magnificent. The track was visible for a time varying from a quarter to half an hour.

SEVERAL large landslips are reported as having taken place on the Danish island of Möen, on a chalky rock named "Möensklint;" from another one, called "Jetterbrinken," a piece of several million cubic yards has fallen down. These occurrences are ascribed to enormous changes in the temperature which have lately taken place in that locality.

THE Royal Geological Society of Ireland have just published Part I. vol. iv., new series, of their journal. It contains: On a new genus of fossil fish of the order Dipnoi, by Dr. Traquair; On the microscopic structure of Irish granites and of the Lambay porphyrite, by Prof. Hull; On a bed of fossiliferous "kunkur," by J. E. Gore; On the Leinster coal-field, by J. McC. Meadows; On a raised estuarine beach at Tramore Bay, by E. Hardman; On the elevated shell-bearing gravels near Dublin, by the Rev. Maxwell Close; and Remarks on the genera Palæchinus and Archæocidaris, by W. H. Baily.

THE Forty-third Annual Report of the Royal Zoological Society of Ireland has just been published. The number of visitors to the gardens of the Society during 1874 was 109,923, and the receipts from the same, 1,442*l.* 14*s.* 4*d.* The number of visitors would appear to have been the smallest during the last ten years, but owing to an increase of the admission fees the income is scarcely below that of the best of the ten years. The Council propose to construct "an Elephant Compound on the plan of those so well known in the London Gardens," the total cost of which will amount to 150*l.*

THE additions to the Zoological Society's Gardens during the last week include two Feline Douracoulis (*Nyctipithecus felinus*) and two Squirrel Monkeys (*Saimaris sciurea*) from Brazil; a Saffron Cock of the Rock (*Rupicola crocea*) from Demerara; a Grey Mullet (*Mugil capito*), twelve Cottus (*Cottus bubalis*), and eighteen Basse (*Labrax lupus*), all British, deposited and purchased.

PRELIMINARY INQUIRY INTO THE EXISTENCE OF ELEMENTS IN THE SUN NOT PREVIOUSLY TRACED *

IN a paper communicated to the Royal Society on December 12, 1872 (Phil. Trans. 1873, p. 253), I have shown that the test formerly relied on to decide the presence or absence of a metal in the sun, namely, the presence or absence of the brightest and strongest lines of the metal in question in the average solar spectrum, was not a final one, and that the true test was the presence or absence of the longest lines of the metal: this longest line being that which remains longest in the spectrum when the pressure of the vapour is reduced.

Of the test in question I have said in the paper already mentioned, "It is one, doubtless, which will shortly enable us to

* Extract from a memoir presented to the Royal Society in November 1873, which has just been printed in the "Philosophical Transactions."

determine the presence of new materials in the solar atmosphere, and it is seen at once that to the last published table of solar elements—that of Thalén—must be added zinc, aluminium, and possibly strontium, as a result of the new method."

In order to pursue the inquiry under the best conditions, complete maps of the long and short lines of all the elements are necessary. It is, however, not absolutely necessary for the purposes of a preliminary inquiry to wait for such a complete set of maps, for the lists of lines given by the various observers may be made to serve as a means of differentiating between the longest and shortest lines, because I have also shown that the lines given at a low temperature, by a feeble percentage composition, or by a chemical combination of the vapour to be observed, are precisely those lines which appear longest when the complete spectrum of the pure dense vapour is studied.

Now with regard to the various lists and maps published by various observers, it is known (1) that very different temperatures were employed to produce the spectra, some investigators using the electric arc with great battery power, others the induction spark with and without the jar; (2) that some observers employed in certain cases the chlorides of the metals the spectra of which they were investigating, others used specimens of the metals themselves.

It is obvious, then, that these differences of method could not fail to produce differences of result; and accordingly, in referring to various maps and tables of spectra, we find that some include large numbers of lines omitted by others. A reference to these tables in connection with the methods employed shows at once that the large lists are those of observers using great battery power or metallic electrodes, the small ones those of observers using small battery power, or the chlorides. If the lists of the latter class of observers be taken, we shall have only the longest lines, while those omitted by them and given by the former class will be the shortest lines.

In cases therefore in which I had not mapped the spectrum by the new method of observation referred to in my paper, I have taken the longest lines as thus approximately determined; for it seemed desirable, in view of the very large number of unnamed lines, to search at once for the longest elemental lines in the solar spectrum without waiting for a complete set of maps.

A preliminary search having been determined on, I endeavoured to get some guidance by seeing if there was any quality which differentiated the elements already traced in the sun from those not traced; and to this end I requested my assistant, Mr. R. J. Friswell, to prepare two lists showing broadly the chief chemical characteristics of the elements traced and not traced. This was done by taking a number of the best known compounds of each element (such, for instance, as those formed with oxygen, sulphur, chlorine, bromine, or hydrogen), stating after each whether the compounds in question were unstable or stable. Where any compound was known not to exist, that fact was indicated.

Two tables were thus prepared, one containing the solar, the other the more important non-solar elements (according to our knowledge at the time).

These tables gave me, as the differentiation sought, the fact that in the main the known solar elements formed stable oxygen-compounds.

I have said in the main, because the differentiation was not absolute, but it was sufficiently strong to make me commence operations by searching for the outstanding strong oxide-forming elements in the sun.

The result up to the present time has been that *strontium*, *cadmium*, *lead*, *copper*, *cerium*, and *uranium*,* in addition to those elements in Thalén's last list, would seem with considerable probability to exist in the solar reversing layer. Should the presence of *cerium* and *uranium* be subsequently confirmed, most of the iron group of metals will thus have been found in the sun.

As another test, certain of those elements which form unstable compounds with oxygen were also sought for, gold, silver, mercury being examples. None of these were found.

The same result occurred when the lines due to the jar-spark taken in chlorine, bromine, iodine, and those of some of the other non-metals were sought, these being distinguishable as a group by formation of compounds with hydrogen.

Now other researches, not yet completely ready for publication, have led me to the following conclusions:—

I. The absorption of some elementary and compound gases is limited to the most refrangible part of the spectrum when the gases are rare, and creeps gradually into the visible violet part, and finally to the red end of the spectrum, as the pressure is increased.

II. Both the general and selective absorption of the photospheric light are greater (and therefore the temperature of the photosphere of the sun is higher) than has been supposed.

III. The lines of compounds of a metal and iodine, bromine, &c., are observed generally in the red end of the spectrum, and this holds good for absorption in the case of aqueous vapour.

Such spectra, like those of the metalloids, are separated spectroscopically from those of the metallic elements by their columnar or banded structure.

IV. There are in all probability no compounds ordinarily present in the sun's reversing layer.

V. When a metallic compound vapour, such as is referred to in III., is dissociated by the spark, the band spectrum dies out, and the elemental lines come in, according to the degree of temperature employed.

Again, although our knowledge of the spectra of stars is lamentably incomplete, I gather the following facts from the work already accomplished with marvellous skill and industry by Secchi of Rome.

VI. The sun, so far as the spectrum goes, may be regarded as a representative of class (β) intermediate between stars (α) with much simpler spectra of the same kind, and stars (γ) with much more complex spectra of a different kind.

VII. Sirius, as a type of α, is (1) the brightest (and therefore hottest?) star in our northern sky; (2) the blue end of its spectrum is open; it is only certainly known to contain hydrogen, the other metallic lines being exceedingly thin, thus indicating a small proportion of metallic vapours; while (3) *the hydrogen lines in this star are enormously distended*, showing that the chromosphere is largely composed of that element.

There are other bright stars of this class.

VIII. As types of γ the red stars may be quoted, the spectra of which are composed of channelled spaces and bands. Hence the reversing layers of these stars probably contain metalloids, or compounds, or both, in great quantity; and in their spectra not only is hydrogen absent, but the metallic lines are reduced in thickness and intensity, which in the light of V., *ante*, may indicate that the metallic vapours are being *associated*. It is fair to assume that these stars are of a lower temperature than our sun.

I have asked myself whether all the above facts cannot be grouped together in a working hypothesis which assumes that in the reversing layers of the sun and stars various degrees of "celestial dissociation" are at work, which dissociation prevents the coming together of the atoms which, at the temperature of the earth and at all artificial temperatures yet attained here, compose the metals, the metalloids, and compounds.

On this working hypothesis, the so-called elements not present in the reversing layer of a star will be in course of formation in the coronal atmosphere and in course of destruction as their vapour-densities carry them down; and their absorption will not only be small in consequence of the reduced pressure of that region, but what absorption there is will probably be limited wholly or in great part to the invisible violet end of the spectrum in the case of such bodies as the pure gases and their combinations, and chlorine. (See I. *ante*.)

The spectroscopic evidence as to what may be called the plasticity of the molecules of the metalloids, including of course oxygen and nitrogen, but excluding hydrogen, is so overwhelming, that even the absorption of iodine, although generally it is transparent to violet light, may (as I have found in a repetition of Dr. Andrews' experiments on the dichroism of iodine, in which I observed the spectrum) in part be driven into the violet end of the spectrum, for iodine in a solution in water or alcohol at once gives up its ordinary absorption properties, and stops violet light.*

A preliminary comparison of the ordinary absorption spectrum of a stratum of 6 ft. of chlorine renders it not improbable that chlorine at a low temperature is the cause of some of the Fraunhofer lines in the violet, although, as said before, I have not yet obtained certain evidence as to the reversal of the bright lines of chlorine seen in the jar-spark.

There is also an apparent coincidence between some of the faint Frauenhofer lines and some of the lines of the low temperature absorption-spectrum of iodine.

Should subsequent researches strengthen the probability of this

* Potassium has since been added.

* I have since obtained the same result by observing the absorption of I vapour in a white-hot tube.

working hypothesis, it seems possible that iron meteorites will be associated with the metallic stars and stony meteorites with metalloidal and compound stars. Of the iron group of metals in the sun, iron and nickel are those which exist in greatest quantity, as I have determined from the number of lines reversed. Other striking facts, such as the presence of hydrogen in meteorites, might also be referred to.

An interesting physical speculation connected with this working hypothesis is the effect on the period of duration of a star's heat which would be brought about by assuming that the original atoms of which a star is composed are possessed with the increased potential energy of combination which this hypothesis endows them with. From the earliest phase of a star's life the dissipation of energy would, as it were, bring into play a new supply of heat, and so prolong the star's light.

May it not also be that if chemists take up this question which has arisen from the spectroscopic evidence of what I have before termed the plasticity of the molecules of the metalloids taken as a whole, much of the power of variation which is at present accorded to metals may be traced home to the metalloids? I need only refer to the fact that, so far as I can learn, all so-called changes of atomicity take place when metalloids are involved, and not when metals alone are in question.

As instances of these, I may refer to the triatomic combinations formed with chlorine, oxygen, sulphur, &c. in the case of tetrad or hexad metals.

May we not from these ideas be justified in defining a metal, provisionally, as a substance, the absorption-spectrum of which is generally the same as the radiation-spectrum, while the metalloids are substances the absorption-spectrum of which, generally, is not the same? In other words, in passing from a cold to a comparatively hot state, the plasticity of these latter comes into play, and we get a new molecular arrangement. Hence are we not justified in asking whether the change from oxygen to ozone is but a type of what takes place in all metalloids?

My best thanks are due to Mr. R. J. Friswell for the valuable aid he has afforded me in these investigations.

J. NORMAN LOCKYER

SCIENTIFIC SERIALS

Poggendorff's Annalen der Physik und Chemie, 1874, No. 12.—This number completes vol. 153 of the series, and contains the following papers:—On the capacity of liquids for conducting heat, by A. Winkelman; account of experiments based upon the same method which Stefan employed successfully for determining the heat-conducting capacity of air, and results tabulated for water, alcohol, bisulphide of carbon, glycerine, and solutions of chlorides of potassium and sodium.—On the elastic after-effects in torsion motions, by F. Neesen.—Experimental researches on the behaviour of non-conducting bodies under the influence of electric forces, by Ludwig Boltzmann. The author starts from the correct supposition that, according to the theories of Clausius, Maxwell, and Helmholtz on the behaviour of dielectric non-conductors in the electric field, the remarkable yet obvious consequence results (which seems to have been overlooked hitherto), that electric forces must necessarily exercise perceptible attraction upon non-conductors simply on account of their dielectric polarisation. The results he obtained were quite in correspondence with the theories his experiments were based upon.—On the action of electrophora, by P. Riess.—Critical remarks on electro-dynamics, by H. Helmholtz.—On the power of conducting electric currents in metallic sulphides, by Ferdinand Braun. This paper is a supplement to another one by Herr Herwig (vol. 153, No 9, of these *Annals*), on the behaviour of iron and steel rods in galvanic currents.—On the reflection of light from the two surfaces of a lens, by Dr. Krebs. It is a well-known fact, that when light passes through a lens and we neglect the absorption in the interior of the lens itself, a certain quantity of light is reflected by the surfaces of the lens. Dr. Krebs for the first time gives a mathematical account of this phenomenon.—On the apparent place of a luminous point situated in a denser transparent medium, or that observed through a so-called plane-parallel plate, by K. L. Bauer. The author arrives at the conclusion that in most works on physics, and especially on optics, misrepresentations of the point in question are contained, and quotes as examples the works of Mousson, Wüllner, Crüger, Müller, Riedel, Schabus, Krebs, Frick, Bänitz, Weinhold, and Jochmann; the only praiseworthy exception he found was Harting's excellent work on the microscope.—On some new sulphur salts, by R. Schneider (tenth paper). The new salts mentioned in this paper are a compound of the formula—

$$Na_2S,Tl_2S_3 + Tl_2S,Tl_2S_3$$

and another one of the formula Tl_6S_7.—On a new eye-piece, by Dr. H. Krüss. The author points out that the latest improvements in optical instruments generally applied to object-glasses, and that the eye-pieces remained where Huyghens and Ramsden left them; he therefore directed his attention to the improvement of eye-pieces, which he describes. Whether these improvements will answer their purpose, practical experiments only can show.—A note, by G. Wiedemann, on the dissociation of salts containing water. Mr. Wiedemann claims priority with regard to the investigations of M. Debray (*Comptes Rendus*, t. 66, p. 194, 1868).—A note on the theory of electricity, by E. Edlund.—A note by F. Lippich, on an electro-dynamic experiment of F. Zoellner, described in these *Annals*, vol. 153, p. 138.—A note by O. E. Meyer, on a paper by Dr. G. Baumgartner, on the influence of temperature upon the velocity of effluence of water flowing from tubes (these *Annals*, vol. 153, p. 44).—A note by H. Baumhauer, on a paper of Dr. F. Exner, on the solution-figures upon the surfaces of crystals (these *Annals*, vol. 153, p. 53). Mr. Baumhauer points out that these figures are quite independent of the crystallographic construction of the substances undergoing solution.—On the rays of light which decompose the xanthophyll of plants, by J. Wiesner. Finally, A. Gawalovski describes a self-acting mercury valve for shutting off gases, and preventing their passage in any but the desired direction.

THE *Journal of the Chemical Society* for January contains the following papers:—Action of bromine in presence of water on bromo-pyrogallol and on bromo-pyrocatechin, by Dr. J. Stenhouse. The action of bromine on pyrogallol gives rise to the formation of a yellow crystalline body of the formula $C_{18}H_4Br_{14}O_6$ in accordance with the equation—

$$4C_6H_3Br_3O_3 + 11Br_2 + 6H_2O = C_{18}H_4Br_{14}O_6 + 6CO_2 + 20HBr.$$

The author has not been able to determine the constitution of this body, but proposes to name it provisionally *xanthogallol*. Alkalies act upon xanthogallol in presence of ether in the following manner:—

$$C_{18}H_4Br_{14}O_6 + 3NaHO = C_{18}H_7Br_{11}O_9 + 3NaBr.$$

The excess of alkali at the same time reacts with the substance and forms an alkaline salt. The action of bromine and water on bromo-pyrocatechin gives rise to a crimson crystalline compound of the formula $C_{18}H_2Br_{10}O$, which the author has named provisionally *erythro-pyrocatechin*. This body is formed as follows:—

$$4C_6H_2Br_4O_2 + 5Br_2 + 5H_2O'' = C_{18}H_2Br_{10}O + 6CO_2 + 16HBr.$$

The next paper is by the same author, on the action of bromine on protocatechuic acid, gallic acid, and tannin. When protocatechuic acid is heated with excess of bromine in sealed tubes at 100° tetrabromopyrocatechin is produced, in accordance with the reaction—

$$C_7H_6O_4 + 4Br_2 = C_6H_2Br_4O_2 + CO_2 + 4HBr.$$

The protocatechuic acid used was prepared from East Indian kino. Gallic acid heated with bromine to 100° gives rise to the formation of tribromopyrogallol, $C_6H_3Br_3O_3$. The reaction in the case of tannin is different according as the substance is perfectly dry or contains water. The action of chlorine on protocatechuic acid and on pyrogallol has likewise been studied.—On propionic coumarin and some of its derivatives, by W. H. Perkin. The author prepares this body by the action of propionic aldehyde on sodium-salicyl hydride. β-bromopropionic coumarin has been prepared by substituting sodium-bromosalicyl hydryde for sodium-salicyl hydride in the preparation of propionic coumarin. The same body is produced by the action of bromine in excess on propionic coumarin. By the further action of bromine (dissolved in CS.) in a sealed tube heated to 150°, β-dibromopropionic coumarin is produced. Fuming sulphuric acid dissolves propionic coumarin with the formation of a sulpho-acid of the formula $C_{20}H_{16}O_4S_2O_6$.—Action of the organic acids and their anhydrides on the natural alkaloids, Part II.: Butyryl and benzoyl derivatives of morphine and codeine, by G. H. Beckett and Dr. C. R. A. Wright. The action of butyric acid on codeine gives rise to the formation of dibutyryl-codeine, $C_{36}H_{40}(C_4H_7O)_2N_2O_6$. Butyric aldehyde yields the same body when heated with codeine. When morphine is substituted for codeine, an analogous compound,

dibutyryl morphine, $C_{34}H_{36}(C_4H_7O)_2N_2O_6$, is formed, and at the same time a non-crystalline base isomeric with this latter body is produced. Butyric anhydride heated with morphine forms a tetrabutyril derivative, which is decomposed on long-continued boiling with water into the dibutyryl derivative. The authors next treat of acetyl-butyryl-morphine, obtained by heating the alkaloid with a mixture of the acids. Benzoic anhydride gives with codeine a di-derivative, and with morphine a tetra-derivative, which is decomposed by water into dibenzoyl-morphine. Benzoic acid gives, with morphine, an α-di-derivative. The action of benzoic anhydride on α-diacetyl-morphine has been studied, and likewise the action of benzoic and acetic anhydrides on tetra-acetyl-morphine and on tetra-benzoyl-morphine.—The last paper communicated to the Society in the present number is by E. A. Parnell, on the use of potassium permanganate in volumetric analysis, and on the estimation of iron in iron ores.

Gazzetta Chimica Italiana, fascicolo ix. and x.—These parts contain the following papers:—On the dilatation of phosphorus, by G. Pisati and G. de Franchis; Action of sulphur on water and on calcium carbonate, by Brugnatelli and Pelloggio; Researches on the nature and constitution of tannic acid, by Hugo Schiff; Refractive indices of cymene, benzene, and of some derivatives of natural and synthetical thymol, by G. Pisati and E. Paterno. A. Casali contributes a paper on chrome green. Search for amylic alcohol in spirits of wine, by C. Bettelli. J. Macagno describes a volumetric process for determining phosphoric acid.—The concluding paper is by Grassi, on the fermentation of must.—The part contains also a number of abstracts of papers published in other journals.

Memorie della Societa degli Spettroscopisti Italiani, November 1874.—This number contains a discussion of the coincidence of the lines in the spectrum of Jupiter with that of our atmosphere, by Father Secchi, in which he appears to disagree with the conclusions arrived at by Vogel as to the coincidence of the lines and the brightness of the same.—The same author contributes a note on the comparison of the spectra of the compounds of carbon with the spectrum of Coggia's Comet; and for reasons given by him he considers the spectrum of the oxides of carbon best correspond to that of the comet; and further, he considers one of the spectra of the electric arc most similar, for he has observed two spectra superposed when viewing that arc. On examining the spectrum of the comet with a polariscope the continuous spectrum disappeared, leaving only that of the bands, proving apparently that the continuous spectrum is reflected light only. Drawings of the chromosphere for July, August, September, October, and November, by Secchi, accompany this number.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Feb. 11.—"On the Structure and Development of *Myriothela*," by Prof. Allman.

The endoderm of the body is shown to be composed of numerous layers of large spherical cells of clear protoplasm. Externally it is continued in an altered form into the tentacles, while internally it forms long thick villus-like processes which project into the cavity of the body.

Interposed between the endoderm and the ectoderm is the *fibrillated layer*. It consists of longitudinal muscular fibrillæ, closely adherent to the outer surface of a structureless hyaline membrane—the "Stützlamelle" of Reichert.

The *ectoderm* is composed of small round cells containing yellowish granules. Among these the thread-cells may be seen, lying chiefly near the outer surface of the body.

The deeper part of the ectoderm consists of cells, each of which is prolonged into a tail-like process, so that they assume a claviform shape.

The male and female sporosacs are borne by the trophosome.

The generative elements, whether male or female, originate in a special cavity (gonogenetic chamber), which is formed in the substance of the endoderm of the sporosac.

Immediately after its expulsion it is seized by the sucker-like extremities of certain remarkable organs (claspers), which are developed among the blastostyles and resemble long filiform and very contractile tentacles.

The actinuloid, on its escape from its capsule, is provided not only with long arms but with short scattered clavate tentacles. The short clavate tentacles become the permanent tentacles of the fully developed hydroid; the long arms, on the other hand, are purely embryonic and transitory.

The long embryonic arms originate in the spheroidal *Planula*. They are formed by a true invagination, and at first grow inwards into the body-cavity of the *Planula*. It is only just before the escape of the actinuloid from its capsule that they evaginate themselves and become external.

After enjoying for one or two days its free existence, during which it moves about by the aid of its long arms, the embryo fixes itself by its proximal end, the long arms gradually disappear, the short permanent tentacles increase in number, and the essential form of the adult is soon acquired.

Linnean Society, Feb. 18.—Dr. G. J. Allman, F.R.S., president, in the chair.—The following papers were read:—On the structure, affinities, and probable source of the large Human Fluke, *Distoma crassum*, Busk, by Dr. T. S. Cobbold, F.R.S. The author commenced by recording all the facts he could gather respecting the original discovery of the parasite by Prof. Busk, dwelling especially on the circumstance that an interval of thirty years had elapsed since the first examples were made known to science. He next referred to other singular instances of the supposed rarity of certain human helminths, adducing the cases of *Tænia nana* and *Distoma heterophyes;* and he also remarked upon the long lapse of time occurring between the periods of discovery and verification of particular species of Entozoa, instancing the cases of *Stephanurus dentatus* and *Distoma conjunctum*. He was indebted to Dr. George Johnson, F.R.S., for having brought the new hosts on bearers of *Distoma crassum* under his observation. The patients, a missionary and his wife, had been four years resident in China, most of their time being spent at Ningpo, where they had partaken freely of fish, oysters, and salads. The author of the paper had secured seven parasites, two from the lady and five from her husband. Only two of the seven specimens supplied him with such new facts as he had been able to make out in respect of the organisation of the animal. The only example which gave the best results Dr. Cobbold had since deposited in the University Museum at Oxford (Prof. Rolleston's department). He found the vitelligene glands to be largely developed, and he believed that in place of there being two testes, as had hitherto been conjectured, there was only one large compound gland, with remarkably large and conspicuous seminal ducts. These ducts were well seen in the dried specimen exhibited to the Society. The hitherto supposed upper testis turned out to be the ovary, and there was a special and smaller organ in front of the ovary which he regarded as an unusually developed shell-gland. The intestinal tubes are simple and unbranched, but on the other hand the uterine organ appeared not to consist of a single continuous tube, but to be partly branched, as obtains in *D. lanceolatum*, and in some other less known flukes. The remainder of the communication was taken up with remarks on the affinities of the parasite, and with a brief *résumé* of the hitherto known facts of trematode development, in so far as they tended to throw light on the source of *Distoma crassum*. In particular he referred to the labours of Mr. Moseley in connection with the land planarians of Ceylon, to the contributions of Giard, Claparède, Pagenstecher, and others in respect of *Bucephalus*, and to the still more recent discoveries of Dr. Ernst Zeller as regards the destiny of *Leucochloridium*. From a general review of all the data thus obtained, Dr. Cobbold believed that the *Distoma crassum* had been obtained by the consumption, on the part of the missionary and his wife, either of Ningpo oysters or of fish insufficiently cooked. After the reading of the paper Mr. G. Busk and Dr. G. Johnson added a few more facts respecting the parasite.—On the external anatomy of *Tanais vittatus*, by Dr. M'Donald.

Mathematical Society, Feb. 11.—Prof. H. J. S. Smith, F.R.S., president, in the chair.—Prof. Cayley communicated two short notes: on a point in the theory of attractions, and on the question of the mechanical description of a quartic curve.—Prof. Sylvester exhibited a new sort of lady's fan, and briefly indicated its mode of construction and properties. With the fan it is possible to divide any angle into any assigned equal number of parts, and the trajectories of points taken in the several links connecting together the sticks of the fan have finite nodes whose numbers are successively, 1, 2^4, 3^4, 4^4. . . . He then dwelt in detail on the expression of the curves generated by any given system whatever of linkwork under the form of an irreducible determinant. The author stated: That parallel motions exist at

all is a paradox more wonderful than ever, now that his method gives the means of determining the conditions to be satisfied and comparing their number with that of the disposable constants. The orders for 3, 5, 7 bars are 6, 20, 72. Formerly the existence of *one* was doubted; now a finite number for *every* order of link-work is rendered highly probable.—The Secretary then read portions of papers by Rev. W. H. Laverty, Mr. E. J. Routh, F.R.S., and Mr. J. Griffiths. Mr. Laverty's paper discussed a particular case of Peaucellier's problem. Mr. Routh discussed Laplace's problem of three particles. Laplace showed that if three particles be placed at the corners of an equilateral triangle and be properly projected, they will move under their mutual attractions so as always to remain at the angular points of an equilateral triangle. On the supposition that the law of attraction is the inverse kth power of the distance, Mr. Routh arrives at the following results:—1. The motion cannot be stable unless k is less than 3. 2. The motion is stable, whatever the masses may be, if the law of force be expressed by any positive power of the distance, or any negative power less than unity. For other powers the stability will depend on the relation between the masses. 3. The motion is stable to a first approximation if $\frac{(M+m+m')^2}{Mm+Mm'+mm'} > 3\left(\frac{1+k}{3-k}\right)^2$ where M, m, m' are the masses. This agrees with a result given by M. Gascheau (in a paper not seen by the author), if $k=2$, or the law of force be the law of nature. 4. When two of the masses are much smaller than the third, the inequality in their angular distances, as seen from the large body, has a much greater coefficient than their linear distances from the same body. 5. On proceeding to a second approximation it would seem that the form of the triangle joining the three particles is very little altered by any disturbance, but in certain cases, depending on the nature of the disturbance, the size of the triangle may be subject to very considerable variations. As a supplement, Mr. Routh generalises the reasoning of the problem of the three bodies so as to obtain the form of the determinantal equation to find the periods of oscillation of any dynamical system about a state of steady motion in which the *vis viva* is constant. Two limitations are made: first, the system must be under a conservative system of forces; and, secondly, the *vis viva* can be expressed in terms of the co-ordinates, so as not to contain the time explicitly. The equation is then shown to be always of an *even* order, and the condition of stability is that all the roots should be real and negative.—The results arrived at in Mr. Griffiths' note on some relations between certain elliptic and hyperbolic functions may be thus stated:—Let E, F, H stand for the integrals

$$\int \sqrt{1-e^2\sin.^2\theta}\, d\theta, \quad \int \frac{d\theta}{\sqrt{1-e^2\sin.^2\theta}}$$

$$\int \sqrt{e'^2\,\mathrm{cosec.}^2\theta - 1}\,\mathrm{cosec.}\,\theta\, d\theta$$

respectively, the limits in each case being θ_0 to θ, and $ee'=1$, then

$$eH + E - (1-e^2)F + \left(\sqrt{1-e^2\sin.^2\theta}\cot.\theta\right)_{\theta_0}^{\theta} = 0$$

and

$$\frac{E+E'}{H+H'} = e^2\sin.\theta\sin.\phi\sin.\theta_0\sin.\phi_0$$

where the limits in E', H' are ϕ_0 to ϕ, determined from the equation—

$$\cos.\theta\cos.\phi - \sin.\theta\sin.\phi\sqrt{1-e^2\sin.^2\mu} = \cos.\mu$$
$$= \cos.\theta_0\cos.\phi_0 - \sin.\theta_0\sin.\phi_0\sqrt{1-e^2\sin.^2\mu},$$

μ being a constant.

Geological Society, Feb. 10.—Mr. John Evans, F.R.S., president, in the chair.—The following communications were read:—The phosphorite deposits of North Wales, by Mr. D. C. Davies. The deposit of phosphate of lime described by the author is a bed varying from ten to fifteen inches in thickness, which occurs at the top of the Bala limestone over a considerable district in North Wales, having been detected in various localities from Llanfyllin to the hills north and west of Dinas Mawddy. The bed is rendered black by the presence of graphite, and appears to consist of concretions of various sizes cemented together by a black matrix. The concretions are richest in phosphate of lime, some of them containing 64 per cent.; the average amount in the bed, including the matrix, is 46 per cent. The deposit is underlain by a bed of crystalline limestone, and sometimes divided by thin beds of similar limestone into two or three layers. The author noticed the principal fossils occurring in the Bala limestone below the phosphorite beds, and stated that many of those in the overlying shales, up to a certain distance above the bed, are phosphatised. The author referred to the presence of phosphate of lime in the inner layers of Unio and Anodonta to the amount of as much as 15 per cent., and thought that the phosphate of lime in the deposit was probably of organic origin. It may have been an old sea-bottom on which the phosphate of lime of Mollusca and Crustacea was accumulated during a long period, and seaweeds may also have contributed their share. It probably represented the remains of an ancient Laminarian zone. The author suggested that the phosphatic nodules of the so-called coprolite beds in other parts of England might have been derived from the denudation of similar deposits.—On the bone-caves in the neighbourhood of Castleton, Derbyshire, by Rooke Pennington, LL.B.; communicated by Prof. W. Boyd Dawkins, F.R.S. The author described as a prehistoric cave the Cave Dale Cave, situated in Cave Dale, just below the keep of Peveril Castle. The upper earth in this cave contained fragments of late pottery mixed up (by rabbits) with bits of rude prehistoric pottery, a tooled piece of stag's horn, an iron spike, two worked flints, a piece of jet, part of a bone comb, and a bronze celt of peculiar form, many bones of *Bos longifrons* and goat, broken to get out the marrow, and remains of hogs; charcoal and human teeth also attested the occupation of the cave by man. There were also remains of fox, badger, cat, water-rat, dog, red deer, duck, fowl, and hare. Lower down were remains of *Bos longifrons*, hog, red deer, wolf, and horse; and lower still, next the rock, more human teeth, remains of animals, and a good flint. The cave seemed to have been occupied from time to time during a lengthened period, probably from the Neolithic age into those of bronze and iron. A cave in Gelly or Hartle Dale contained, in blackish mould, bones (some broken) of goat, pig, fox, and rabbit, and pieces of very rude prehistoric pottery. Of Pleistocene caves and fissures the author described several. One in Hartle Dale furnished remains of rhinoceros, aurochs (*Bison priscus*), and mammoth, lying in yellow earth. The bones were probably carried in by water. A fissure near the village of Waterhouses, in Staffordshire, is six feet wide, and filled with the ordinary loam. Bones of mammoths and the skeleton of a young bison have been obtained from it, and the author supposes the animals to have fallen into the fissure while making for the river to drink. The Windy Knoll fissure is situated near Castleton, in a quarry near the top of the Winnetts, and close to the most northern boundary of the mountain limestone of Derbyshire. The author described particularly the situation of this fissure and drainage of the district in which it is situated. The fissure itself is filled with the ordinary loam, containing fragments of limestone, and enclosing an astonishing quantity of bones of animals confusedly mixed together, those lowest down near the rocks being coated with and sometimes united by stalagmite. The author supposes that this was a swampy place into which animals fell from time to time, and in rainy seasons their remains might be washed into it from the neighbouring slopes.—The Mammalia found at Windy Knoll, by Prof. W. Boyd Dawkins, F.R.S. This paper contained an enumeration of the remains of Mammalia found in the Windy Knoll fissure described by Mr. Pennington. They were stated to belong to the following species: bison, reindeer, grisly bear, wolf, fox, hare, rabbit, and water-rat. Great quantities of bones and teeth were found, the number of individuals represented by the remains being given roughly by the author as follows:—

Bison	40–60
Reindeer	20–30
Grisly bear	4–5
Wolf	7

From the great excess of herbivorous forms, and the position of the fissure, the author assumed that the latter lay in the line of the annual migrations of the bison and reindeer, during which some individuals might fall in; and he explained the presence of the carnivores by their having followed the migratory herds in order to prey upon stragglers, as is now the case with the reindeer in Siberia and the bison in North America. He further showed, from the examination of the young teeth of the bison and the reindeer, that these animals must have passed this way at different seasons of the year, and indicated that the deposit must be regarded as of Pleistocene age, though whether pre- or post-glacial is an open question.

Meteorological Society, Feb. 17.—Dr. R. J. Mann, F.R.A.S., president, in the chair.—The following communications were read:—Report of the Conference on the Registration of Phenological Phenomena. The Council of the Society resolved during last session that it was expedient that observations of natural phenomena connected with the return of the seasons, as well as of such branches of physical inquiry as tend to establish a connection between meteorological agencies and the development of vegetable life, should be organised on a more systematic and scientific basis than heretofore. Application was made to other societies interested in the matter to nominate delegates to form a committee for the purpose of drafting complete instructions and organising in an efficient manner this branch of investigation. Delegates were appointed by the Royal Agricultural, Royal Horticultural, Royal Botanic, Royal Dublin, Marlborough College Natural History, and the Meteorological Societies; and meetings of this joint committee have been held, when the subject was fully discussed, and reports, prepared by the Rev. T. A. Preston, M.A., and Prof. T. Dyer, F.L.S., on plants; Mr. McLachlan, F.L.S., on insects, and Prof. A. Newton, F.R.S., on birds, were adopted.—On the weather of thirteen summers, by R. Strachan, F.M.S. This paper is in continuation of others read before the Society on the different seasons of the year.—On a universal system of meteorography, by Prof. Van Rysselberghe. This paper gave a description of a recording apparatus by means of which the indications of a great number of meteorological instruments of any kind can be registered, whether they are placed near to or far from it, so that simultaneous readings of several instruments at various distant stations can be recorded at a central observatory. The chief feature in this recorder is, that it engraves automatically on metal the different curves, thus furnishing a plate graduated by the apparatus itself, from which as many copies as may be desired can be struck off. Another feature is, that a single burin, put in motion by a simple electro-magnet, can engrave successively, on the same metallic plate, the elements of all the curves.

Zoological Society, Feb. 16.—Mr. George Busk, F.R.S., vice-president, in the chair.—Dr. Sclater exhibited a drawing of a supposed new Rhinoceros from the Terai of Bhootan, which had been forwarded to him from Calcutta, by Mr. W. Jamrach, who had the animal there alive, and intended bringing it to England.—Mr. Sclater exhibited and made remarks on a living specimen of the Peguan Tree Shrew (*Tupaia peguana*), which had been presented to the Society by the Hon. Ashley Eden, Chief Commissioner at Rangoon, British Burmah. This was believed to be the first specimen of a living *Tupaia* of any species that had reached Europe.—Mr. A. H. Garrod read a paper on a point in the mechanism of the bird's wing, which renders it so specially adapted for flight.—Mr. Sclater read remarks on the Cassowaries now living in the Society's Gardens, amongst which were representatives of five different species. One of them from the south of New Guinea was believed to be new to science, and proposed to be called *C. picticollis*. Mr. Sclater also gave notice of a new Cassowary obtained in the Aroo Islands by Signor Beccari, and transmitted to the Museo Civico of Genoa, which he proposed to call *Casuarius beccarii*.—Prof. Owen, C.B., communicated a note on the discovery of the remains of various species of *Dinornis* in the province of Otago, New Zealand.—Mr. Edward R. Alston read a paper on *Anomalurus*, its structure and position, in which he came to the conclusion that this peculiar form of Rodents should be either referred to the Sciurine group of Rodents as a distinct sub-family, or placed next to it as a separate family—*Anomaluridæ*.—Mr. H. E. Dresser read some notes on the nest and eggs of *Hypolais caligata*, and on the egg of *Charadrius asiaticus*, and made remarks on the latter species, and on *Charadrius veredus*.—Mr. R. Bowdler-Sharpe communicated a paper on the birds of Labuan, in which was given an account of a collection made in that island by Mr. John Low.

Entomological Society, Feb. 1.—Sir Sidney Smith Saunders, C.M.G., president, in the chair.—Mr. Stevens exhibited a variety of *Noctua glareosa*, and Mr. Champion some specimens of *Amara continua*, a species recently detected in this country.—Mr. Herbert Druce exhibited a fine collection of *Rhopalocera* recently received from Santarem.—The President exhibited a nest of *Polistes gallica* taken on the esplanade at Corfu, of which the cells were partly constructed with coloured paper taken from some playbills posted in the vicinity, as alluded to in his anniversary address delivered at the last meeting.—Mr. Smith remarked on *Colletes cunicularia* having been found a few years ago in the Isle of Wight and in Liverpool. In 1873 he had transported some specimens from the latter locality to Shirley Common, and he had reason to believe that he had succeeded in establishing a colony there, as the insect had been taken near the spot in 1874 by Mr. d'Arcy Power.—A paper was communicated by Mr. A. G. Butler on the *Rhopalocera* of Australia.—A paper was read by Mr. W. Arnold Lewis on "Entomological Nomenclature and the Rule of Priority."—The President nominated Messrs. Dunning, Pascoe, and Weir as vice-presidents for the ensuing year.

Feb. 15.—Sir Sidney Smith Saunders, C.M.G., president, in the chair.—Mr. Phipson exhibited a singular variety of *Strenia clathrata* from Basingstoke, the wings being nearly unicolorous.—Mr. F. Smith exhibited a second collection of *Hymenoptera* from Mr. Rothney, of Calcutta, containing 1,573 specimens, all in the finest condition. There were probably not more than twenty-five undescribed species, but from twenty to thirty species (which were hitherto represented in the British Museum by a single sex) were here represented by both sexes.—Mr. Verrall exhibited some living fleas taken two days previously from inside the ears of a rabbit near Lewes. They were gregarious in this situation, and in such a position that the animal was unable to dislodge them by scratching. He alluded to a communication made to him by Mr. M'Lachlan regarding a species from Ceylon which was gregariously collected in a very limited space on the neck of a fowl, and which had been exhibited at a recent meeting of the Microscopical Society. They were affixed to the skin of the fowl by the proboscis, so that only the tails were visible outwards. Mr. Cole said he had found fleas in a hedgehog, and Mr. W. Arnold Lewis had observed a species in a marmot in Switzerland.—Mr. Dunning called attention to a recent extract from a French paper in which it was stated that a paint could be manufactured from cockchafers.—The Rev. R. P. Murray stated that Mr. Edwards, of Virginia, was very desirous of obtaining pupæ of *Pieris napi*.

Royal Geographical Society, Feb. 22.—Sir H. Rawlinson presided.—A paper was read by Capt. J. Moresby, giving an interesting commercial, political, and geographical description of discoveries in Eastern New Guinea, made by himself and the officers of her Majesty's ship *Basilisk* during a recent voyage, undertaken to substantiate and follow up a previous similar exploration. The practical outcome appears to have been the establishment of the fact that the D'Entrecastraux group of islands, sighted ninety-four years ago, consists of three large islands, separated from each other and the main land of New Guinea by narrow straits. These islands the captain and his crew were the first to visit and survey, and it may be said they are now politically appropriated in the British interest. The captain has named the islands Normanby, Fergusson, and Goodenough; while he calls the straits Ward Hunt, Goschen, Dawson, and Moresby. These islands, he states, extend north and south about ninety miles, and afford harbour and anchorage.

Institution of Civil Engineers, Feb. 16.—Mr. Thos. E. Harrison, president, in the chair. The paper read was on the erosion of the bore in heavy guns, and the means for its prevention, with suggestions for the improvement of muzzle-loading projectiles, by Mr. C. W. Lancaster, Assoc. Inst. C.E.

CAMBRIDGE

Philosophical Society, Feb. 8.—The following communication was made:—On the centre of motion of the eye, by Prof. Clerk-Maxwell. The series of positions which the eye assumes as it is rolled horizontally have been investigated by Donders (Donders and Doijer, *Derde Jaarlijksch Verslag betr. het Nederlandsch Gasthuis voor Ooglijders;* Utrecht, 1862), and recently by Mr. J. L. Tupper (Proc. R.S., June 18, 1874). The chief difficulty in the investigation consists in fixing the head while the eyeball moves. The only satisfactory method of obtaining a system of co-ordinates fixed with reference to the skull is that adopted by Helmholtz (*Handbuch der Physiologischen Optik*, p. 517), and described in his Croonian Lecture. A piece of wood, part of the upper surface of which is covered with warm sealing-wax, is placed between the teeth and bitten hard till the sealing-wax sets and forms a cast of the upper teeth. By inserting the teeth into their proper holes in the sealing-wax the piece of wood may at any time be placed in a determinate position relatively to the skull. By this device of Helmholtz the patient is relieved from the pressure of screws and clamps applied to the skin of his head, and he becomes free to move his head as he likes, pro-

vided he keeps the piece of wood between his teeth. If we can now adjust another piece of wood so that it shall always have a determinate position with respect to the eyeball, we may study the motion of the one piece of wood with respect to the other as the eye moves about. For this purpose a small mirror is fixed to a board, and a dot is marked on the mirror. If the eye, looking straight at the image of its own pupil in the mirror, sees the dot in the centre of the pupil, the normal to the mirror through the dot is the visual axis of the eye—a determinate line. A right-angled prism is fixed to the board near the eye in such a position that the eye sees the image of its own cornea in profile by reflection, first at the prism, and then at the mirror. A vertical line is drawn with black sealing-wax on the surface of the prism next the eye, and the board is moved towards or from the eye till this line appears as a tangent to the front of the cornea, while the dot still is seen to cover the centre of the image of the pupil. The only way in which the position of the board can now vary with respect to the eye is by turning round the line of vision as an axis, and this is prevented by the board being laid on a horizontal platform carried by the teeth. If now the eye is brought into two different positions and the board moved on the platform, so as to be always in the same position relative to the eye, we have to find the centre about which the board might have turned so as to get from one position to the other. For this purpose two holes are made in the platform, and a needle thrust through the holes is made to prick a card fastened to the upper board. We thus obtain two pairs of points, $A\ B$ for the first position, and $a\ b$ for the second. The ordinary rule for determining the centre of motion is to draw lines bisecting $A\ a$ and $B\ b$ at right angles. The intersection of these is the centre of motion. This construction fails when the centre of motion is in or near the line $A\ B$, for then the two lines coincide. In this case we may produce $A\ B$ and $a\ b$ till they meet, and draw a line bisecting the angle externally. This line will pass through the centre of motion as well as the other two, and when they coincide it intersects them at right angles.

MANCHESTER

Literary and Philosophical Society, Feb. 2.—Mr. Alfred Brothers, F.R.A.S., president of the section, in the chair.—Results of meteorological observations taken at Langdale, Dimbula, Ceylon, in the year 1873, by Mr. Edward Heelis; communicated by Mr. Joseph Baxendell, F.R.A.S.

Feb. 9.—Mr. Edward Schunck, F.R.S., president, in the chair.—A method of finding the axes of an ellipse when two conjugate diameters are given, by Mr. J. B. Millar, B.E.; communicated by Prof. O. Reynolds.—Mr. E. W. Binney, F.R.S., V.P., presented to the Society a bust of the late James Wolfenden, of Hollinwood, one of the most noted mathematicians of the Lancashire school, who was born on the 22nd June, 1754, and died on the 29th March, 1841.

DUBLIN

Royal Irish Academy, Jan. 11.—William Stokes, F.R.S., president, in the chair.—The Secretary read a paper, by Mr. J. Rhys, of Rhyl, on Ogham inscriptions.—Dr. Edmund Davy read a paper on some newly observed properties possessed by certain salts of fulminic acid.—Dr. Doberck, astronomer at Col. Cooper's observatory, Markree, County Sligo, read a paper on the Comet I. of 1845.

Jan. 25.—William Stokes, F.R.S., president, in the chair.—The Rev. Edward M'Clure read a paper on Irish popular names.—Samuel Ferguson, LL.D., vice-president, read a paper on an Ogham inscription at Mullagh, Co. Cavan; also notices of the Monataggart Ogham texts, from the Bishop of Limerick, Whitley Stokes, LL.D., and Rev. R. D. Haigh.—Rev. Dr. Reeves, vice-president, read a paper on the MS. in Marsh's Library called the "Codex Kilkennensis."—Mr. H. W. Mackintosh read a paper on the structure of the spines in the Diadematidæ.—Dr. A. Macalister read a paper on a few points in the cranial osteology of *Bradypus gularis*;" also a paper on the anatomy of insectivorous Edentates, Part I.

PARIS

Academy of Sciences, Feb. 15.—M. M. Frémy in the chair.—The following papers were read:—New researches on the mode of intervention of electro-capillary forces in the phenomena of nutrition, by M. Becquerel.—On the depth and the superposition of magnetic layers in steel, by M. J. Jamin.—M. Faye made some remarks on M. Jamin's paper.—M. de Lesseps then made a communication relative to the question of unification of the tonnage of vessels; after which M. Dupuy de Lome made some remarks on the same.—Experiments on the absorption by the root of plants of the red juice of *Phytolacca decandra*, by M. H. Baillon. These experiments are in continuance of those made by Biot, De la Baïsse, and Unger.—On the defective notes of string instruments, by M. A. Dien. This paper has special reference to the violin and violoncello, and treats of those harsh and buzzing notes commonly known by musicians as the *wolf*.—On the presence and the formation of *vibriones* in the pus from abscesses, by M. Albert Bergeron; researches made at the Charité Hospital, in Paris, in pursuance of M. Goselin's paper read at the meeting of Jan. 11 (NATURE, vol. xi., page 240).—On a dissemination apparatus of *Gregarina* and *Stylorhynchus*, and a remarkable phase of sporulation in the latter genus, by M. A. Schneider.—A memoir, by M. Ch. Antoine, on some mechanical properties of saturated steam.—A memoir, by M. A. Picard, on a new method to establish the equations of elasticity of solid bodies.—A note by M. M. Girard on the influence of cold temperatures upon Phylloxera, showing that these insects are not much affected by cold, and that it is useless to count upon their destruction by cold winters.—A note, by M. A. Demoget, on various improvements made upon Holtz's machine; these improvements ensure its perfect action even in the dampest weather.—The Secretary then read the following telegram received from M. Bouquet de la Grye, the chief of the expedition sent to Campbell to observe the Transit of Venus:—"Venus seen before ingress only; no contacts; all well." It is dated from San Francisco.—A note, by M. E. Rivière, on the quaternary deposits, superior to the ossiferous cavern of Nice, known as the superior cavern of Cuvier. The author considers that the red inferior deposit in the caverns of Mont-du-Chateau, of Nice, must be regarded as the true ossiferous breccia, and that the superior deposits were formed by accumulations of detrital matter. The animals whose bones originate from this deposit were contemporary to the human beings of which Cuvier described a jawbone.—On a case of dimorphism in the genus of Gramineæ, by M. E. Fournier.—On the discovery of true Batrachia in primary strata, by M. A. Gaudry.—On the discovery of a fossil species of Bovidæ, probably *Bubalus antiquus*, at Djelfa, Algeria, by M. P. Gervais. The same gentleman then showed some reproductions of flint implements found in the caves of Ousidan, near Tlemcen, Algeria.—A note by M. Chapelat, relative to a large bolide supposed to have been observed on the evening of Feb. 10. It was afterwards found that the supposed meteor was only the edge of a cloud brilliantly illuminated by the sun, which had already set.—A note, by M. de la Haye, on atmospheric electricity and the presence of hydrogen in the atmosphere.

BOOKS AND PAMPHLETS RECEIVED

AMERICAN.—Papers on Natural Erosion by Sand in the Western Territories; The Recency of certain Volcanoes of the Western United States; and the advantages of the Colorado Plateau Region as a Field for Geological Study: G. K. Gilbert (American Association for the Advancement of Science).—Report of the State Board of Education on the proposed Survey of the Commonwealth (Boston, Wright and Potter).—Monthly Report of the Department of Agriculture, Nov. and Dec. 1874 (Washington, U.S.)

CONTENTS

PAGE

A GERMAN MANUAL OF SCIENTIFIC INQUIRY 321
THE SANDWICH ISLANDS (*With Illustrations*) 322
OUR BOOK SHELF:—
Dr. Hall's "Sun and Earth" 324
LETTERS TO THE EDITOR:—
On the Building up of the Tone in the "Gamba" Organ-pipe.—Dr. HERMANN SMITH 325
Periodicity of Rainfall.—C. MELDRUM 327
Ice-Caves.—Rev. T. G. BONNEY 327
The Morse Code.—Prof. W. F. BARRETT 328
The Micrographic Dictionary—Pollen Grains.—W. G. SMITH . . 328
OUR ASTRONOMICAL COLUMN:—
ζ^1 and ζ^2 Reticuli 328
The Binary Star η Cassiopeæ 328
The Binary Star α Centauri 328
Red Stars 328
Encke's Comet 328
BEARING OF METEOROLOGICAL RECORDS ON A SUPPOSED CHANGE OF CLIMATE IN SCOTLAND. By ALEXANDER BUCHAN 329
NATURAL PHENOMENA IN SOUTH AMERICA. By J. MUNRO (*With Illustrations*) 329
THE BIRMINGHAM COLLEGE OF SCIENCE 331
NOTES 332
PRELIMINARY INQUIRY INTO THE EXISTENCE OF ELEMENTS IN THE SUN NOT PREVIOUSLY TRACED. By J. N. LOCKYER, F.R.S. . . . 334
SCIENTIFIC SERIALS 336
SOCIETIES AND ACADEMIES 337
BOOKS AND PAMPHLETS RECEIVED 340

DIARY OF SOCIETIES.

LONDON

THURSDAY, FEBRUARY 25.

ROYAL SOCIETY, at 8.30.—On the Integration of Algebraical Functions with Illustrations in Mechanics: W. H. L. Russell, F.R.S.—On the Forms of Equipotential Curves and Surfaces, and Lines of Electric Force: Bakerian Lecture: Prof. W. G. Adams, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—Further Notes on St. Hugh's Work in Lincoln Cathedral: J. H. Parker, C.B., F.S.A., and Sir G. G. Scott, R.A., F.S.A.—On the Brasses of Buckinghamshire, with an Exhibition of Rubbings: A. W. Franks, F.R.S., Dir. S.A.

ROYAL INSTITUTION, at 3.—Electricity: Prof. Tyndall.

LONDON INSTITUTION, at 7.—Physiology of Sleep: Dr. Richardson.

FRIDAY, FEBRUARY 26.

ROYAL INSTITUTION, at 9.—Popular Tales, their Origin and Meaning: W. R. S. Ralston.

JUNIOR PHILOSOPHICAL SOCIETY, at 7.30.—Evolution of the Sexual Organs of Flowers: G. S. Boulger.

QUEKETT MICROSCOPICAL CLUB, at 8.—Histology of the Eye: B. T. Lowne.

SATURDAY, FEBRUARY 27.

PHYSICAL SOCIETY, at 3.—On the Lines of Flow and Equipotential Lines in a uniformly conducting Sheet: G. C. Foster, F.R.S., and O. J. Lodge.—On a Mode of Exhibiting to a large Audience the Spectrum of Sodium: T. Wills, F.C.S.

ROYAL INSTITUTION, at 3.—The General Features of the History of Sciences: Prof. Clifford.

SUNDAY, FEBRUARY 28.

SUNDAY LECTURE SOCIETY, at 4.—Erasmus: A. E. Finch.

MONDAY, MARCH 1.

SOCIETY OF ARTS, at 8.—Cantor Lecture; The Material, Construction, Form, and Principles of Tools and Contrivances used in Handicraft: Rev. Arthur Rigg, M.A.

VICTORIA INSTITUTE, at 8.—The Chronology of Recent Geology: S. R. Pattison.

ENTOMOLOGICAL SOCIETY, at 7.

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

LONDON INSTITUTION, at 5.—Travers' Course.

TUESDAY, MARCH 2.

ZOOLOGICAL SOCIETY, at 8.30.—Notes on *Falco labradorus*, Aud., *Falco sacer*, Forster, and *Falco spadiceus*, Forst.: H. E. Dresser.—Monographic List of the Coleoptera of the genus *Plusiotis*: A. Boucard, C.M.Z.S.—On the Tracheæ of some of the rarer species of Anatidæ and of other Birds: Prof. A. H. Garrod.

HORTICULTURAL SOCIETY, at 2.30.—Council Meeting.

ROYAL INSTITUTION, at 3.—Animal Locomotion: Prof. A. H. Garrod.

WEDNESDAY, MARCH 3.

SOCIETY OF ARTS, at 8.—On the Mercantile Marine of Great Britain: Capt. Bedford Pim. Reply to Discussion.

MICROSCOPICAL SOCIETY, at 8.

HORTICULTURAL SOCIETY, at 11.—Fruit and Floral Committee and Exhibition. Meeting of Scientific Committee.

THURSDAY, MARCH 4.

ROYAL SOCIETY, at 8.30.

LINNEAN SOCIETY, at 8.—Note on the Structure of the Seed in Cycads: Prof. Dyer, F.L.S.

ROYAL INSTITUTION, at 3.—Subjects connected with Electricity: Prof. Tyndall, F.R.S.

LONDON INSTITUTION, at 7.—Lecture.

CHEMICAL SOCIETY, at 8.—On the Chemical Constitution of the Brain: Dr. Thudichum.—On the Dissociation of Nitric Acid: Messrs. P. Graham and J. W. Gatehouse.—Researches on the Action of the Copper-Zinc Couple on Organic Bodies. No. VIII. On Chloroform, Bromoform, and Iodoform: Dr. J. H. Gladstone and Mr. A. Tribe.

TORQUAY

MONDAY, MARCH 1.

NATURAL HISTORY SOCIETY, at 12, noon.—Chemistry: E. Smith.

LEEDS

TUESDAY, MARCH 2.

NATURALISTS' FIELD CLUB, at 8.—Exhibition of Specimens and Conversation.

EDINBURGH

THURSDAY, MARCH 4.

GEOLOGICAL SOCIETY, at 8.—Notice of a large Striated Boulder recently exposed in Tynecastle Sandpit, Gorgie Road, Edinburgh: D. Milne Home, LL.D., F.G.S.—On Phenomena of Glaciation exhibited by the Rocks of Corstorphine Hill, Edinburgh: Ralph Richardson.

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